NATURE MAGAZINE

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Loye H. Miller has made field studies of nature sounds for more than fifty years. As Professor of Biology in the University of California, Los Angeles, he has long been noted for his teacher-training, his leadership in nature study groups, and his talks about birds and animals. He is a Fellow of the American Association for the Advancement of Science, a Fellow of the American Ornithological Union, and an Honorary Member of the Cooper Ornithological Club.

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Birds of Kutch

The Birds of Kutch. By Salim Ali. New York. 1946. Oxford University Press. (Printed in India.) 175 pages. About 100 species illustrated in color. $10.00.

Kutch is one of the States of northern India and is a great aerial junction for birds, lying on the eastern fringe of a broad stream of migration that flows from central and northern Asia southward and westward to Arabia, Abyssinia and even as far as South Africa. A flat strip of salt, barren, sandy waste known as the Rann of Kutch is the only known nesting place of the flamingo in India, and an outstanding place for observation of bird migration. This book is the result of an ornithological study by the author sponsored by His Highness Maharao Vijayarajji.

British Trees

Trees in Britain. By L. F. J. Brimble. New York. 1946. The Macmillan Company. 352 pages. Illustrated in color and black and white. $4.50.

This is a popular guide to the wild and cultivated trees of Great Britain, and a companion volume to *Flowers in Britain,* written by the same author. We were interested to note that California redwoods do well in Great Britain and that study is being made as to the possibilities of this tree for reforestation and economic use. Throughout the text of this book the author has introduced interesting and apt literary references to the species of trees covered.

Directory

Published regularly for sixty years, *The Naturalists' Directory* will appear in a new edition for 1946 in September. It contains names, addresses and special subjects of study of professional and amateur naturalists throughout the world. This book sells for three dollars and is published at Salem, Massachusetts. Valuable as a reference to naturalists, it has to our mind, one weakness in that those listed are arranged by States, making it necessary to know the geographical location of an individual whose name and address are sought. There is no cross-listing.

Mushroom Hunting

"Exploring for Mushrooms" is the title of an attractive and practical booklet by Virginia S. Eifert, published as No. 3 in the Story of Illinois series brought out by the Illinois State Museum at Springfield. The booklet is an introduction to some of the commoner mushrooms of Illinois and the central states. Miss Eifert's own illustration of the publication is most effective, and the accompanying text is popular and for the beginner.

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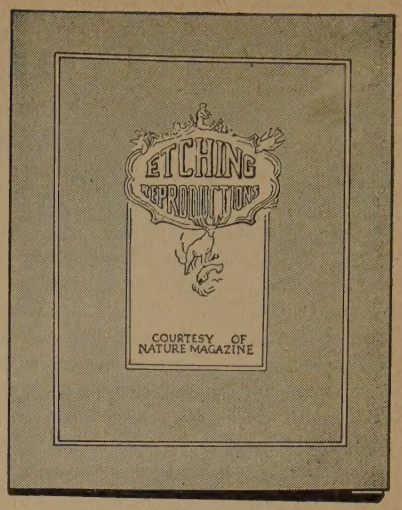

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Nature in Print

By HOWARD ZAHNISER

MISS EVELYN SPENCER, whose whereabouts at present I ungratefully do not know, was, nearly thirty years ago, the inspiring teacher of the fifth-grade class in Ellwood City, Pa., of which I was a member, enjoying a privilege on which I could only later set a proper value, one that was never again a part of my school opportunities—the privilege of sharing an instructor's enthusiasm for bird study and enjoyment. Surveying three bird-study books recently made available, I have been carried back again to those fifth-grade days when a new world was shown to me. During a few after-school half-hours and as hostess at her country home, Miss Spencer (for her Nature teaching was extra-curricular) conducted a Junior Audubon Society, which she skillfully assumed that we had organized. I can remember not only the bird watching in the ravine behind my home (where the cardinals were brighter than any I now see), and at Miss Spencer's home (where I first beheld the tropical wonder of the Baltimore oriole), but also the thrill of receiving the Audubon Society's bird-study leaflets, carrying about a copy of my own of Reed's pocket guide, and finally acquiring by purchase C. M. Weed's 2-volume *Bird Life Stories: Compiled from the writings of Audubon, Bendire, Nuttall, and Wilson*—books that I still frequently hold in my hand with a peculiar pride. I still look with high appreciation on Audubon bird-study leaflets, also, once in a while with my children coloring the outlines that accompany their color plates. I have no fault to find with my own fifth-grade opportunity and would consider it a good fortune for any boy today. Yet I am impressed with the great additional advantages that have been made available for bird students of today. Here at hand is a new addition to the list of excellent State bird books—*Birds in Kansas,* in this case—and here is a bird-study manual that will surely tease many of us to wish that we might be in college again with it. And with them is Ludlow Griscom's *Modern Bird Study*—as delightful serious reading as one might wish for.

Birds in Kansas might make one wish to be in Kansas to enjoy fully its 250 pages of the annotated list, yet the 60-page introduction that its author (Dr. Arthur L. Goodrich, Jr., of Kansas State College) has written under the titles "Birds and Mankind," "The Life of a Bird," and "The Body of a Bird" is excellent and pertinent reading under any State flag. And the six color plates of the book, all bound within the pages of this introduction, will bring appreciation to the artist, Margaret Whittemore of Topeka, from many distances. The western meadowlark plate, used also on the cover of the paper-bound books, is indeed one of those highly-prized bird plates that is at once an illustration and a delight in itself—from an original that would certainly look good on the wall. Dr. Goodrich has surely provided for the schools of Kansas, as well as for the State's general readers, a volume that will be appreciated, and any of us at a distance can consider ourselves fortunate to have had the opportunity of reading it.

A Laboratory and Field Manual of Ornithology, by Olin Sewall Pettingill, Jr., of Carleton College, Minnesota, is a finely multilithed volume of 8½-by-11-inch pages spirally bound, "designed primarily for use in ornithological study at the college and university level." To use it successfully the author believes that "the student must have taken a college course in general zoology or biology." Yet a general reader need not merely wish that he might again be given a college chance. With no one to judge his prerequisites he can simply start in with this manual, and unless my experience is entirely unreliable he will find himself both entertained and instructed—limited only by his devotion of time and his willingness to use a dictionary. Furthermore, I know of no work that has within it so many helpful references, nor one that can itself serve better as an illustrated reference for detailed understanding of such matters as bird anatomy that occasionally interest yet perplex the general reader. And, finally, it would be unfortunate if only in classrooms or in classroom connections the really exquisite drawings made for this manual by Walter J. Breckenridge of the Minnesota Museum of Natural History could be enjoyed.

With material selected chiefly for use in spring and summer courses (yet pertinent at any time in the arm-chair), the text of this manual "consists of eighteen sections, each with an outline of basic information, directions for making detailed observational studies, and bibliographical references for further inquiries on a specific topic." These eighteen sections, it may be interesting for many bird lovers to know, are on topography (that is, of the bird itself—the head, the neck, etc.), feathers and feather tracts, internal anatomy, classification and nomenclature, external structural characters, laboratory identification, plumages and plumage coloration, distribution and migration, field identification, bird ecology, bird communities, mating, nests and nest building, eggs and incubation, young and their development, parental care, and bird populations. And in appendix form, among other aids, are listings of life history studies, State works on birds, books "for general information and recreational reading," and ornithological journals.

What a privilege it must be at Carleton College to take such a course as the author describes in his preface, and I can testify that if all books here reviewed teased away as much of my time as Professor Pettingill's manual has, my time worries would be even greater than now they are.

Although Ludlow Griscom entitles his recent work *Modern Bird Study,* he writes not as a student, much less as an instructor, but rather as an accomplished scholar, with the charm that term suggests. "The main object of the book," he says, "is to show that the study of birds is not only a branch of scientific research, which need not be a narrow specialty, but that it also contains many topics of interest to the layman, and that the growing army of bird watchers have and can really assist the ornithologist in solving problem after problem by controlled, careful, and thorough observation." *Modern Bird Study* seems to serve well this purpose, yet it appeals to me also as an excellent book for the general reader who may not even be a layman in ornithology, bringing to the book nothing more than an intelligent interest in ideas and the activities of other men. It is, for example, just the book as a gift for your friend who has a taste for serious reading yet never has quite understood your interest in birds.

The book is described as the outgrowth of a series of eight lectures at the Lowell Institute, thoroughly revised and extended into ten chapters—on the development of field ornithology, capacity and intelligence of birds, adaptability of birds, migration (two chapters), distribution (four chapters), and on classification and the species concept. The author surmises that the first five chapters will appeal to any layman with a general interest in birds, but that the others will require some previous knowledge of ornithology. It is a point on which it is indeed bold to differ with an author even slightly, yet it is altogether possible that a general reader with no previous knowledge of birds might even find Ludlow Griscom's discussion of how birds are classified and what makes up a species rather fascinating—for its perplexities are interesting and this author's urbanity makes of his writing the sort of discourse that one might by good chance enjoy with such a man at his ease in a club. And much of the book is so interspersed with incident and recollection as to deepen this impression. The lectures at the Lowell Institute must have been most enjoyable as well as edifying. I quote for example, almost at random, from the chapter on capacity and intelligence of birds:

"One's outstanding impression of birds is that they are bursting with energy. Intense activity. constant alertness. extreme

restlessness, are characteristic of birds, and they seem to require astonishingly little sleep and rest.

"Years ago, in the spring migration in May, it was my custom to arrive at a certain field in New Jersey before dawn. I had a half-mile walk up a railroad track to some woods, which I planned to reach at daybreak. As I walked up this railroad track in the early morning I could hear the calls and chirps of the migrating birds overhead, and as dawn arrived and daylight broke, these chirps and calls would come from a lower and lower altitude, and, finally, I would be able to make out the little forms flying north, a relatively few feet overhead. On one occasion a small warbler flew down into a little maple tree on the edge of the track, and, as a matter of interest, I stayed there and watched what it did. It kept perfectly still for twenty minutes, and for a part of this time it had its head under its wing. It was obviously resting from the fatigues of its night flight, and it may have slept part of this time. During the course of this twenty minutes it became bright daylight, and I was able to identify the bird as a Nashville warbler. At the end of this twenty minutes, it seemed to revive, began to hop about the tree, and obviously found some insects to eat; then it began to sing, and in a minute or two it proceeded to fly north, presumably at least as far as the woods in the distance. The impression, of course, was that it had had sufficient rest."

I thoroughly enjoy such writing, and I am more appreciative than I have acted through the years because of the opportunity the good Miss Spencer gave me to develop the taste that is now thus pleased —and also to meet at least in part the prerequisites for a study of Professor Pettingill's manual. Whether we are concerned with our own enjoyment and what we are pleased to call adult education or with the advancement of conservation education in the schools we can value highly such works as these and, each in his own State, such a book as Dr. Goodrich's *Birds in Kansas.*

Birds in Kansas. By Arthur L. Goodrich, Jr., Kansas State Board Agriculture, Topeka. 1946. 340 pp., with preface by J. C. Mohler, 6 color plates by Margaret Whittemore, numerous drawings, and index. Free to Kansans.

A Laboratory and Field Manual of Ornithology. By Olin Sewall Pettingill, Jr. Minneapolis, Minn.: Burgess Publishing Co. 1946 (revised edition). 248 pp., with maps and numerous drawings and sketches by Walter J. Breckenridge, and bibliographies. $3.50.

Modern Bird Study. By Ludlow Griscom. Cambridge, Mass.: Harvard University Press. 1945. 109 pp., with 15 photographs, 10 maps, reference lists, and index. $2.50.

Key to Fungi

Keys to the Common Fleshy Fungi. By Clyde M. Christensen. Minneapolis. 1946. Burgess Publishing Company. 45 pages. Illustrated with line drawings. $1.50.

These illustrated keys to the common fleshy fungi are intended for beginners and are designed primarily for the collector or student who must work alone. At the same time, the keys should be of much use to students and teachers who have not specialized in one or more of the groups of fleshy fungi. In preparing the text the author, who is assistant professor of plant pathology at the University of Minnesota, has avoided the use of technical terms where a common term would serve. This book is published in loose-leaf, spiral binding on one side of the page, the other being left blank for notes.

Big Department

USDA: Manager of American Agriculture. By Ferdie Deering, Norman, Okla. 1945. University of Oklahoma Press. 213 pp., with foreword by B. B. Blackwood. Photographs, appendix showing appropriations 1932-46. $2.50.

The organizations, aims, groupings, accomplishments, plans, responsibilities, history, etc. of the U. S. Department of Agriculture. Much information and considerable opinion about this enormous, complex, expanding, contracting, twisting, shifting, reorganizing, reorienting organization that carries on research, conserves the soil, enforces regulations, does financing, and tries to keep farming, farmers, and our principal national resource on an even keel. It gives special attention to what is called "the new USDA" and winds up with an editorial chapter on "Tomorrow's Agriculture."

C. E. G.

Good Health

Health from the Ground Up. by Karl B. Mickey. Chicago, Illinois, 1946. International Harvester Co., 180 North Michigan Avenue, Chicago 1, Illinois. 125 pages. Free.

With this, and an earlier booklet entitled *Man and the Soil,* the International Harvester Co. has made an important contribution to popular appreciation of the basic importance of soil to our existence. The first publication was concerned with intelligent management of the soil from the quantitative point of view. This companion brochure approaches the subject qualitatively, assembling known data on what soil means to us in point of health. The author also indicates the directions in which further research is going to discover potentialities of the soil as yet unknown or only suspected. Mr. Mickey has told the story in as popular terms as possible, and both booklets are of special value to teachers.

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IN THIS ISSUE

October, 1946 Vol. 39, No. 8

Muskrat .....Hexom Cover
Nature in Print.....Howard Zahniser 394
Contents Noted.....R. W. W. 399
This Tree I Plant (Poem)...Walter O. Terry 400
Pollen—Wonder Dust of Nature
Donald Culross Peattie 401
Lizards at Breakfast.....Tom Wallace 404
Wild "Rooshians" of Tennessee
Carlos Vinson 405
Zamboanga Bill.....Ken Stott, Jr. 407
Insect Synonyms (Quiz).....Paul Churcher 408
Cone Year.....John Lindsey Blackford 409
Thesis Metrical (Poem).....Paul Churcher 412
Birds of Shakespeare
L. McCormick-Goodhart 413
Some Common Butterflies and Moths
E. Laurence Palmer 417-424
Stand By to Repel Raiders (Editorial)..... 425
The Wolverine .....Gordon T. Woods 426
Organization (Poem).....Norman Edson 428
They Grow Large on Okinawa
Ralph J. Donahue 429
"Squeaking" Animals.....J. Alden Loring 430
Gulls Inland (Poem)
John Gallinari Whidding 432
Bombs of Beauty from Holland
Andrew S. Wing 433
October May Provide Meteor Show
Isabel M. Lewis 436
The Night is Music (Poem)
Cosette Middleton 437
The School Page.....E. Laurence Palmer 438
School (Poem)....Mae Winkler Goodman 438
Camera Trails..Edna H. & William J. Evans 440
Under the Microscope.Julian D. Corrington 446

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Sonnet Sequence

While Enemies Conspire. By Eleanor Crandall. North Montpelier, Vermont. 1946. The Driftwind Press. $.75.

Nature runs much through this attractive sonnet sequence, which draws its title from the central theme of separation occasioned by the call to serve one's country. The love that endures through these years apart finds strength in a common love of Nature, as:

"Where in the universe is there a word
For beauty's yellow fire or red flame?
The leaf mistaken for a scarlet bird
Alights upon the ground without a name.
Oh, I would bear your battle with its gore
If you could see my autumn trees once more!"

Just Four Lines

Quatrains. By Albert Ralph Korn. New York. 1946. The Comet Press, 200 Varick Street, New York 14, N. Y. 64 pages. $1.00.

In a foreword concerning the quatrain, Mr. Korn calls it "a pattern of poetry peculiarly adapted to the American temperament. Confined to four lines, its brevity appeals strongly to the atmosphere of our times. There is genuine beauty and great artistry in this form of verse. But a quatrain, in order to be good, must ring with a finality which is impressive. In four lines the poet must say what some poems take twenty lines to say." To prove his point, Mr. Korn provides the reader with fifty-four four-line verses, and demonstrates that he is a master of this form.

Canine Care

Care of the Dog. By Will Judy. Chicago. 1946. Judy Publishing Company. Third Edition. 96 pages. Illustrated. $1.50.

First published in 1940, Will Judy's book has enjoyed a popular reception among dog lovers, and it now appears in a larger, revised, third edition. The author is a dog lover of long standing and author and publisher of many dog books. He writes informally and helpfully about dogs, and any dog owner will find this book handy and helpful to have around.

Plant Chromosomes

Chromosome Atlas of Cultivated Plants. By C. D. Darlington and E. K. Janaki Ammal. London. 1946. George Allen and Unwin, Ltd. Distributed in U. S. by Macmillan, 396 pages. $2.75.

This is a technical volume of interest to students of plants and their chromosomes. It constitutes a world list of the known chromosome numbers of flowering plants, and is of particular importance to the systematic botanist.

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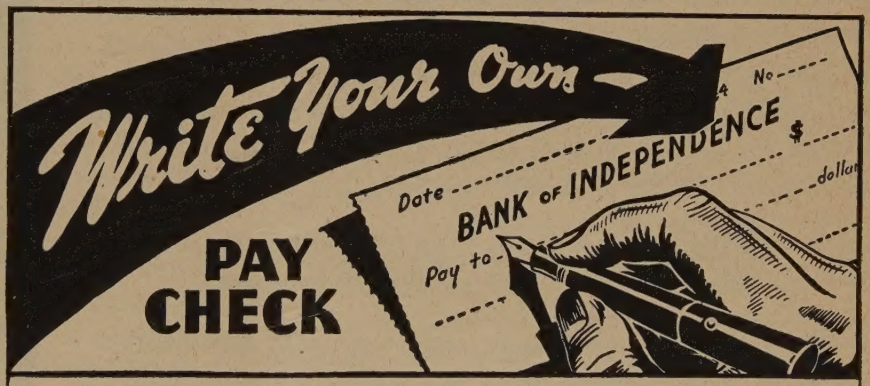

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From statement by Walter S. Gifford, President, American Telephone and Telegraph Company, at 1946 Annual Meeting of stockholders

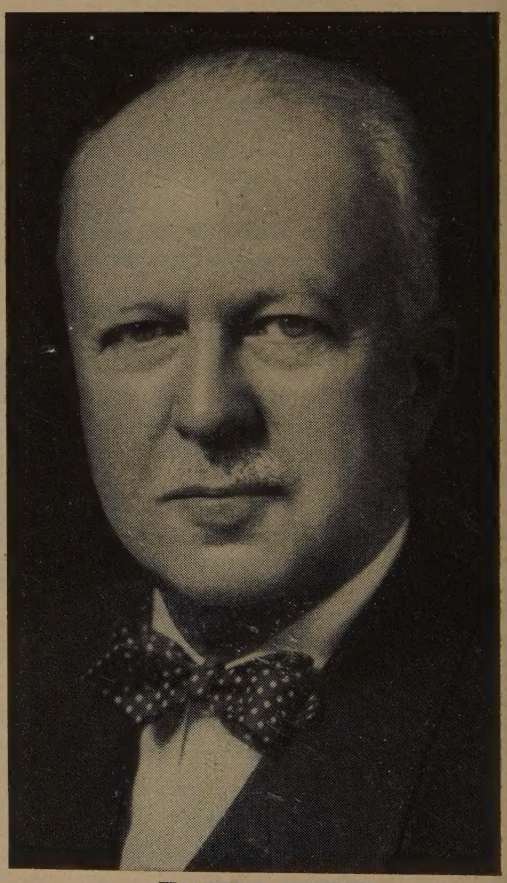
"It is not without significance that our Annual Report opens with the statement that 'The Board of Directors of the American Telephone and Telegraph Company presents herewith the management's accounting of its stewardship for the information of stockholders, employees, telephone users and the entire American people who have entrusted to private enterprise the responsibility for carrying on this essential national service.'

"There is every reason for the management of your company to treat equitably each of the three parties concerned, namely, the telephone users, the employees and the stockholders. For in the long run, the interests of these three great groups of people, individually and collectively, are mutual and interdependent.

"More and better service at the least cost is as much in the interests of stockholders and employees as it is of the telephone users.

"Well-paid employees with steady employment; with opportunities open to all for advancement; and with reasonable protection against contingencies of illness, accident, death and old age are as much to the benefit of telephone users and stockholders as to employees.

"A stable and fair return on the money invested in the business — sufficient to attract the new money needed to develop and expand facilities — is as good for the telephone users and employees as it is for the stockholders."



WALTER S. GIFFORD

BELL TELEPHONE SYSTEM

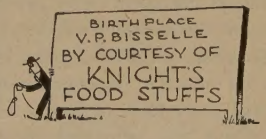
Contents Noted

SOME readers may have wondered just why this page is headed "Contents Noted"; may have forgotten or not seen our original dedication of this editorial watch tower. From month to month much correspondence comes to our desk—commendation and criticism, query and suggestion. Also many, many publicity releases, publications of varied nature, and clippings pile up on our editorial work bench. We note the contents of these. Some find their way into notes published elsewhere in our pages; others go into the file; others pass the capacious maw of the waste-basket. Still other items in this "literary" output contain something meriting pointed comment, or provide us with an opportunity for a touch of humor, irony or ire. We thank the many readers who have been kind enough to say that they find this page worth the few minutes required to read it. So we shall go on noting contents, which is no small part of our many tasks, albeit an always stimulating and interesting part.

HOWARD LAW of Sarasota, Florida, and Mrs. Law are regularly hosts to birds, providing water and food for their guests. He reports observing a bird adoption recently, being led to it by the constant peeping of young birds. He found two young mockingbirds on the ground, "a pretty little female towhee feeding first one and then the other. Hour after hour we watched her do her hoppy, little, two-footed scratching among the leaves and grass, pick up something and place it in the ever-hungry mouth of one of the baby mockingbirds. Of course, we know that the mockingbirds are insect eaters, but the little towhee had to find out the hard way. A number of times she put seeds into the mouths of the babies, only to have them spat out at once, until she seemed to catch on that seeds came out but bugs stayed in."

TYPICAL of the variety of contents recently noted are such bits of wisdom and intelligence as the report from the California Division of Fish and Game that three of five beavers, transported by air to colonize a new location, definitely suffered from air-sickness. And the duPont Company advises us that a plague of grasshoppers in Sardinia was effectively checked by sprayings of a new insecticide called Hexachlorocyclohexane, obviously destined to be shortened to "Hex", a particularly appropriate simplification for the name of a killer that had Sardinian farmers shovelling millions of dead grasshoppers off the roads. Another release records the organization of The Amateur Weathermen of America by David M. Ludlum, The Franklin Institute, Philadelphia 3, Pa. It is designed to be "an association of all followers of the ways of the weather." And from former lieutenant C. Stewart Peterson of Baltimore comes the excellent suggestion that each State adopt an official State Tree as a memorial to the men and women who have given their lives in the armed forces in all our wars.

GOVERNOR TUCK of Virginia is eyeing the noose of the outdoor advertising industry with every apparent intention of sticking his neck in it. He has addressed a letter to all State Governors asking whether they approve urging the oil industries to "form a pool to pay for an outdoor advertising campaign to designate show places, scenic attractions, historic spots and recreational facilities where their products would be used in reaching these destinations." The idea would extend beyond state lines, and such billboards would be erected in neighboring states. Perhaps the Governor thought this up, or it may have been the "bright" idea of one of his administration, or it may have originated with some smart outdoor advertising man who saw an opportunity to get official blessing for his signs on the landscape. The idea certainly will not be approved by some states where the authorities have been seeking to restrict the invasion of billboards, which are regarded as detrimental to the very attractions of which the state is proud. But, offhand and without too much thought, many Governors may approve it, and then the billboard industry will chortle gleefully, don its often-used mask of public service, and buckle on a new weapon to be wielded against anyone suggesting that billboards should be restricted by law, happy in having took Tuck.



ANYONE who has ever bathed in Chesapeake Bay will assert that a sea nettle has no right to exist. It does, however, have its value. It eats quantities of Ctenophores, or "water blisters", which feed on oyster larvae and cut down the amount of oyster spat. When there are many nettles a good set of oysters may be expected. Thus Nature works. R. W. W.

This Tree I Plant

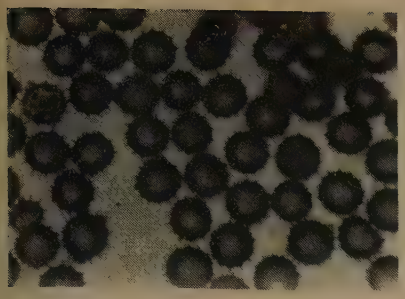
By WALTER O. TERRY

Here in this barren place I plant a tree,
And though the years may tarry not for me
To let me walk beneath its shade,
I shall be filled with wonderment
To know that as I thrust the spade
Deep in the cool receptive earth
And give each root its place,
My hand acquires divinity,
And some great sacrament of grace
Bestows upon my act
Supreme benignity.

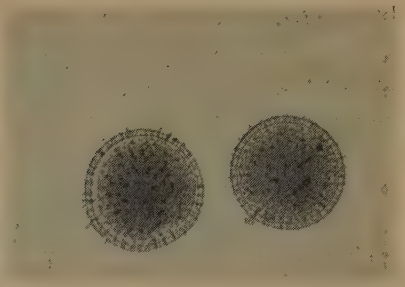
This tiny sprig, no taller than the grass,
Is yet complete; it is a tree;
And as the summers and the winters pass,
Though it shall grow, year after year, a century,
It will maintain its own discreet identity.
It is a token of tomorrow's heritage
And through its planting, my hands cast
A shadow from the burning sun
Across tomorrow's unmarked page:
They raise a barricade
To shelter from the blast
The children of another age.

This tree will be an organ with a thousand melodies;
The winging ones with joyous fluted throats;
The reedy children with their gladdest notes;
The diapason as the north wind swells;
The pealing of the gentle south wind bells;
The tremolo of wavelets on the shore;
The great full organ of the ocean's roar.
This tree will grow to be a Gothic shrine,
Buttressed about and pinnacled above,
With nave and altar where may safely nest
The sacrificial dove.

This tree I plant within the riven sod
Will be a prayer for souls made dumb with grief,
And to the anxious it will speak relief
And prophesy to all, "Have faith in God."



Pollen grains of rose mallow, and, in circle, shell-like pollen grain of a dwarf iris species.



Two spiny pollen grains of the hollyhock seen under the microscope. Insects bear them.

Pollen—Wonder Dust of Nature

By DONALD CULROSS PEATTIE

ALL ABOUT us in the air drifts a miraculous and potent dust of life. Invisible to the naked eye, a grain of pollen yet carries a spark of fecundating life—male life. Some pollens ride the wind to seek their fortune, and you may see them rise in a golden cloud when you tease the curls of a slim alder, or tap the ripe tassels of a pine. Others enslave the dusty bee as she threads her way from flower to flower. But every pollen grain is bound upon a journey, which may be an inch in length, or hundreds of miles, and its destination is a female flower of the same species.

Without pollen no seed would set anywhere in the world, grass would wither, and the fruit tree put forth no fruit. But because of pollen the wheat in the wind bows heavy with its grain, and the young oak rises where the old one fell. For pollen flies across the ever-present chasm of death, and starts the miracle of new life.

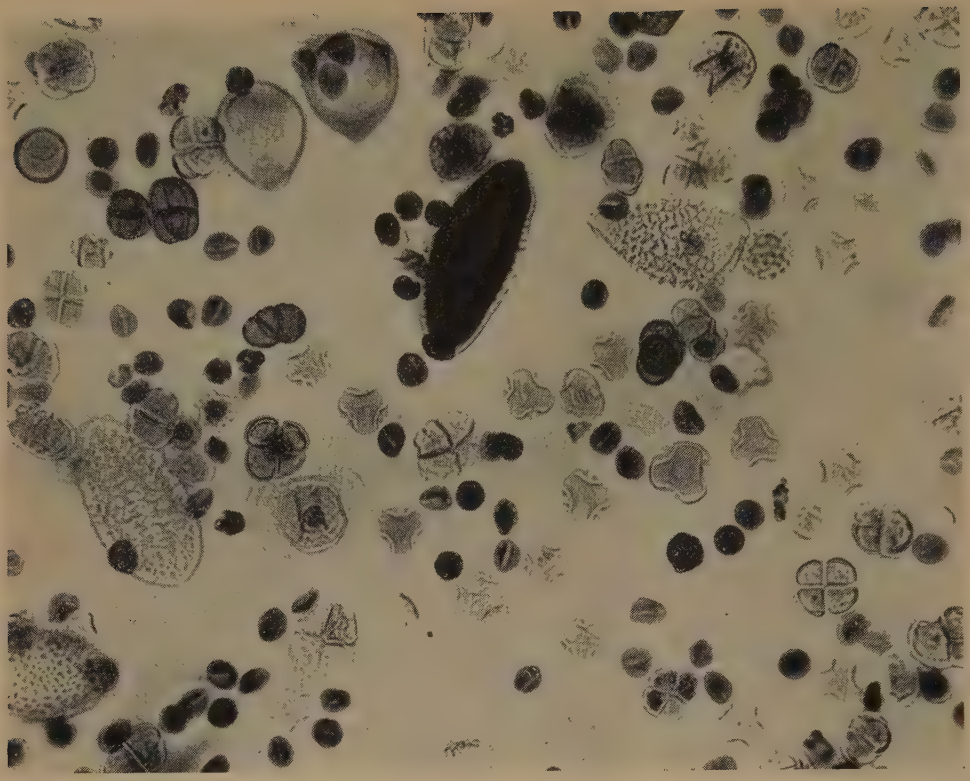
Although so potent, pollen is frailer than a candle in a gale. Always it is in danger of dying of thirst or starvation. Unlike a seed, it has no great reserve within itself. A single drop of dew may kill a pollen grain, for water makes the pollen coat swell up and burst, exposing the male germ to the fatal ultraviolet rays of sunlight. A grain of corn pollen can live under natural conditions only thirty-six hours at best. A small proportion of date pollen has been found still alive after several months. But, artificially preserving it in sealed tubes at cool but not freezing temperatures, plant breeders have sometimes kept apple pollen alive for half a year.

The back of a honey bee laden with grains of pollen, graphically showing how the bee carries these about.

Fragile as snowflakes, prismatic as jewels, fanciful as Christmas tree ornaments, some pollens under my lens appear—to make crude comparisons—like chestnut burrs, photographs of the moon's surface, sea urchins, or clusters of those frilly paper cups around bon-bons. The basic shapes are dominantly spheres and footballs. But pollen may also take the geometric forms of cubes, tetrahedrons, and pentagon dodecahedrons. The biggest grains, such as those of pumpkin flowers, are only one one-hundredth of an inch thick; the pollen of the alpine forget-me-not is one hundred times smaller!

Pollen experts can identify almost any pollen, so they can distinguish those invisible bombers—pollen of ragweed and oaks, grasses and plantain—that drop their poison on hay fever sufferers. Indeed, there are some seventy observation posts in the United States, keeping watch on these flights—wave after wave of them, as the different types, the seasons around, come over. Specialists inform us that even an office high above the street is not sanctuary against pollinosis—as hay fever is more accurately designated.

Luckily not all or even most wind-borne pollens are venomous. Almost no one, for instance, is ever hurt by pine pollen, although it is extremely abundant in spring, and, provided with big air sacs, it has astounding buoyancy—so great indeed that pine



"Fragile as snowflakes, prismatic as jewels, fanciful as Christmas tree ornaments", says Donald Peattie, looking at the grains of pollen under a lens. The basic shapes are dominantly spheres and footballs, but pollen may also take geometric forms.

pollen has been found on the snows of Greenland, although the nearest pine forests are four hundred miles away across open sea in Labrador.

Nor is there much credence to be placed in the old wives' tale of "rose colds." For practically all the flowers with conspicuous petals and fragrance are exclusively insect-pollinated. Their pollen is quite unadapted to wind transport, and normally is never recovered from the atmosphere.

Every child today can instruct his parents in the facts of life from the analogy of the bees and the pollen of flowers. Yet only three hundred years ago the wisest scientists did not know that plants have sex. Or, rather, mankind had forgotten it again, for the Egyptians and Babylonians knew it when they pollinated their date palms by hand. So even the great Renaissance anatomist Malpighi informed his classes that plants rid themselves of pollen to purify their sap!

It was not until 1793 that Pastor Konrad Sprengel discovered in Germany that insects transport pollen from flower to flower. Regarding this as God's prettiest little miracle, he spent so much time in the fields studying flowers and bees that he would forget to come to his fashionable church and preach a sermon, so his congregation dropped him. He was so far ahead of his scientific times that scientists failed to recognize his work till Darwin unearthed it sixty years later.

It was Darwin who first showed that many kinds of flowers have elaborate ways of preventing inbreeding by their own pollen. In some the female organ or pistil is actually infertile to pollen grains from one of its own stamens, and will not produce seed when sprinkled with its own pollen. In certain flowers the stamens ripen before the pistil, in others the pistil ripens before the stamens; hence, for fertilization to take place, the pollen must come from some other plant of the same species whose stamens have ripened later or earlier.

The best all-around pollinator is the common honeybee, which is abroad earlier in spring than any other flower-loving insect, and is the last to leave the field in fall. It has the habit of sticking faithfully to one kind of flower, at least for a while, unlike the butterflies that sip at one kind of blossom after another. The pollen the honeybee carries is therefore likely to arrive at its intended destination—a female flower of the same species. This is important because of the short life of pollen.

A beehive is almost a necessity in apple and orange orchards. The bee is paid for its labors by the large amounts of pollen she carries away to the larval or baby bees in the hive. Although she tucks a great deal of this into a special little pollen basket in her leg, she inevitably becomes dusted with pollen as she clambers around in the bloom, and thus carries a vast amount—sometimes up to half her weight—from one flower to another, inadvertently pollinating hundreds of blossoms a day.

Flowers have almost as many devices for dousing pollen on bees or fixing it to their bodies as there are kinds of flowers visited by these industrious little insects. In the flower the pollen is borne in little tubes called anthers, which open by pores when ripe, and from these the pollen shakes out like talcum powder. Some flowers have little piston systems, so that, as soon as the bee treads among the organs of the flower, the anther comes down like a mallet or piano key

The best all-around pollinator is the common honeybee. Here is one with its saddlebags laden with pollen from sunflowers and on its way to other plants of the same kind to carry on the task of pollination.

and gently strikes the insect, dusting the powder over its body. Others conceal their nectaries in such a way that the bee, to get at them, has to clamber over the anthers and thus scrapes pollen on her abdomen.

One of the most marvelous of all cases of mutual dependence in Nature is that of a little moth that lays its eggs only in the ovary of the yucca plant. The hatching larvae eat some of the seeds, then bore their way out and escape. But no seeds will ripen if the flower is not pollinated. The moth herself performs this rite, quite deliberately. Her mouth parts are specially modified for rolling pollen into little balls, and after she has laid her eggs in the ovary she collects pollen from the anthers and carefully crams it down on the stigma, or receiving surface of the ovary. Without the moth the flower would fail to reproduce itself Without the seeds the moth larvae would die. The act of pollination the moth performs is as expert as if she had a college degree in plant breeding.

This moth was pollinating yuccas at least as far back as the last Ice Age. Yet not until 1717 was the first plant hybrid made by man's hand, when Thomas Fairchild, in England, placed the pollen of a carnation on the female flower of a sweet william. Since then 4000 crosses have been made between China asters; 8000 sorts of tulip have been produced by cross-breeding, while the rose leads the world with 15,000 experimental crosses. Most of this work has been done since 1900, for only with the discovery of Mendel's Law, in 1866, did breeding become an exact science.

Gregor Mendel was an Austrian monk who spent his life pollinating peas in his cloister garden, and proving that nothing, after all, is so *unlike* as two peas in a pod. To a great extent he revealed the secret of heredity, showing that strains repeat themselves in a regular mathematical pattern, and, by breeding, can often be perpetuated, increased, eliminated, or blended. Thus, by pollinating a rose that has a factor (scientists call it a gene) for ever-blooming, but no gene for fragrance, with a rose that has a gene for fragrance but none for ever-blooming, today's breeder hopes to get a rose that will be both fragrant and ever-blooming.

This and far more important things are done by breeders of all sorts of plants from beans to orchids, working with frail pollen as their strongest tool. It is fascinating to visit a plant experiment station and watch the delicate, swift, accurate technique of the breeders.

The varieties to be pollinated first have their own pollen-bearing organs cut out before the bud opens, to prevent inbreeding. Then the bud is shut in a bag to prevent bees from bringing unknown, perhaps undesirable, pollen to the flower. The breeder now goes to the male parent strain he has selected and collects the fresh, fertile pollen just as the flower opens. This he puts in a little glass dish, marked with

Stigma of the flower of a bean, with pollen grains adhering and waiting to be transported to another flower. No pollen, no beans.

the name or number of the bush it came from. He may collect pollen from many varieties at once, and with a whole trayful of dishes he then moves down the row of female parents, each kept immaculate in its bag. Opening each bag, he applies the selected pollen to the stigma of the female flower, closes the bag, and goes on. His work is then complete; he can only await results.

But the pollen grain is just going to work. On the stigma or receptive surface of the female flower it begins to sprout, sending out a very fine tube that grows down and down in the tissues of the ovary, toward the egg cells at the bottom. The distance it may have to travel may be about a thousand times the diameter of the pollen grain, as in the case of the amaryllis. Yet somehow the grain is able to take all this "pipe line" out of itself. For the pollen is actually drawn toward the waiting egg cells by a chemical stimulator called a hormone. This fact has been proved by putting a pollen grain on a moist glass slide, with a tiny piece of the ovary of the same species; the pollen tube grows toward the ovary, guided by the hormone, which has diffused through the water on the slide. So, in the flower, the precious passenger in the pollen grain at last reaches journey's end, and the new life is started.

The result may be a new strain of wheat that will help feed the starving world. It may be a hybrid tea rose, breathing its exquisite perfume in your garden. Or it may be a noble tree to shade the roof of your children's children. Truly, pollen is the wonder dust of Nature.

Lizards at Breakfast

By TOM WALLACE

OUR garden house is a log cabin. More than a century ago it was Lonesome Valley schoolhouse, built without a chimney because in the Lonesome Valley section of Kentucky, when logs for the structure were hewn, roads or trails were too difficult for children in winter, and school "kept" in summer only.

Lonesome Valley schoolhouse.

A friend of mine who publishes a paper in a county-seat town, and serves as postmaster, and makes a hobby of collecting antique furniture, and likes log cabins, found the Lonesome Valley schoolhouse. We had it trucked to our farm, reassembled and set upon a dry-wall foundation of field stone. Lizards came to live in the spaces between the foundation stones.

I had been in a hospital to be overhauled by a surgeon who, when he turned me out, prescribed three weeks of complete rest. He operated the day after the Kentucky Derby was run, and turned me out in time for rest in late May and early June. The lizards and I had the cabin and its surroundings to ourselves much of the time, and we became well acquainted.

A lizard is an expert in the business of resting luxuriously in the sun. He selects the smooth boards of the porch floor rather than the somewhat uneven surface of the stone steps, which lead down from the porch to the turf in the direction of the lily pond and the wildflower garden. There the woodchucks live, and, to a lizard living in the cabin foundation, this garden is foreign and distant lands, as Bulgaria or Baluchistan are to me.

I observed that the lizards liked an early forenoon nap rather than an early afternoon siesta. They took it lying flat with their legs crossed upon their backs, their paws meeting in the region of their spinal columns.

They cooked themselves on the floor boards, which the sun had generously warmed. And they seemed almost happy enough to sing.

One day I moved my chair out on the turf, in the direction from which the lizards invariably came for their naps, to see what they did before napping. After a due period of silence and avoidance of movement I discovered that they breakfasted in the bluegrass. What they ate I was not able to discover, for they found it at the grass roots. But I did see them drinking, and what they drank. Thus fairies drink, beyond doubt, when they do not drink from the chalices of wildflowers.

A blade of grass is a tall growth to a lizard four inches long. It has at its tip, at lizard-breakfast-time in late May or early June, a single gleaming drop of dew. The lizard rears up and takes the blade of grass in its paws and bends it gently until the dew-drop is at lip-level. The lizard quaffs the drop. And then it is time for a nap on a hot floor-board with arms and legs crossed on rusty-brown back and all of the underside of the animal from nose to tail-tip, snugly against the board.

A naturalist, probably, knows how and where a lizard has his matutinal drop of water when drought smites the land and there is no dew. The Lonesome Valley schoolhouse lizards may then organize a caravan and cross the desert, one hundred feet broad, more or less, lying between the stone foundation and the lily pond. But what if there is no lily pond?

Wild "Rooshians" of Tennessee

By
CARLOS VINSON

Photographs courtesy of the Tennessee Conservation Department

TELLICO Game Management Area in the rugged mountains of east Tennessee embraces eighty-seven thousand acres of wild forested area, much of it just as the Indians left it. Prowling this primitive range is a herd of about seven hundred of the wildest wild animals to be found in North America today. They are Russian wild boars.

In 1912, a group of wealthy British sportsmen owned a private hunting preserve in the mountains of western North Carolina. They fenced in a large portion of the preserve with a high, boar-proof fence, and imported twenty-three genuine European wild boars from the Ural and Harz Mountain regions of Europe.

The "Rooshians"—as the native mountaineers of the area call them—multiplied to some extent while they were fenced in. Then came the first World War, and the subsequent failure of the hunting preserve venture. The fence, weakened by forest fires and neglect, failed to hold the animals. They escaped and made their way into the mountains of east Tennessee. Since then they have thrived and increased until some seven hundred inhabit the Tellico Area alone.

There are claims that the Europeans have crossbred with native wild "razorback" hogs, but mountaineers and experienced mountain guides discount this claim. From available evidence it appears, in fact, that the wild immigrants soon drive out razorbacks that have gone wild and take over an area.

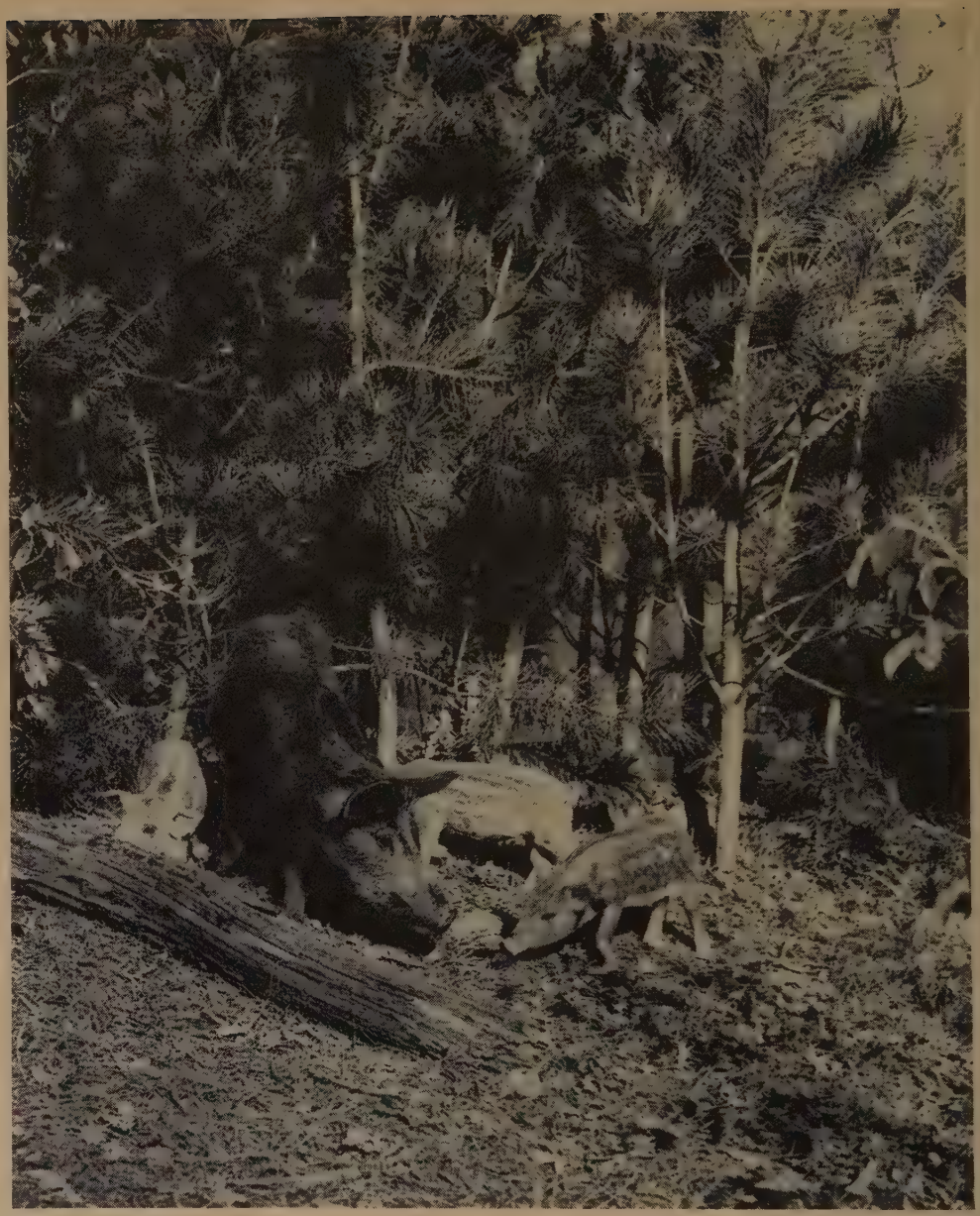
After several years on their own, the domestic hogs acquire habits similar to those of the "Rooshians." The razorbacks develop tusks, coarser and thicker hair, slimmer and more heavily-muscled bodies. Their tusks are straighter than those of the imported boars, but not as long and not as sharp. Also, the tusks of the razorbacks appear only in individuals from four to six years old, while the "Rooshian" will start sprouting tusks during its first year of life.

The true Russian wild boar has large, buffalo-like fore shoulders. These are covered with a layer of skin much thicker and tougher than the skin covering the rest of their bodies. They have comparatively small hind parts, and long bushy tails. The bodies of the razorbacks, however, are the same size, proportionately, in both front and hind parts; their skin is about the same thickness over all parts of their bodies; their tails are short. The European boars have longer snouts; small, beady eyes; coarse and long hair; an undercoat of fine, kinky, tan-colored hair. The outer coat of hair of the "Rooshians" is dark brown, and may appear almost black in the sunlight. The ears of the razorbacks are large and prominent, and the tips usually flop over. The ears of the Europeans are small, pointed and stand up straight.

A few individuals that have been killed or captured near the Tellico Area showed some evidence of having been crossbred. In the immediate area where the "Rooshian" prowls the wilderness as king of the woods, no specimens have been taken that showed any evidence of crossbreeding.

The Russian wild boar, being at home in mountains, has thrived and multiplied, seemingly thoroughly adapting itself to the area. Experienced mountain guides claim that they can whip any animal on four feet in a fair fight, and that they can outrun a scared deer. The boars' tusks, which curve outward, are their chief weapons in a fight with other animals. They have both upper and lower tusks, and the upper set serves as whetstones for the lower set, which are always very sharp.

Sometimes these strange wild beasts travel in herds,



A European wild sow and youngsters, descendants of the original group of twenty-three animals introduced into this country in 1912.

sometimes alone. They usually range from six to fifteen miles a day. They sleep most of the day in laurel and ivy thickets, feeding during the early morning and late afternoon. They live on roots, herbs, twigs, acorns, hazelnuts, beech mast, berries, persimmons, wild grapes, muscadines, papaws, ground-nesting birds and eggs, snakes and salamanders. There are some reports of their devouring young fawns. Their appetites are enormous, especially those of old, wild European sows that happen to be suckling pigs.

The imported boars seem particularly to relish rattlesnakes. Although the bite of a big rattler has little, if any, effect on the "Rooshian", the boar will go about killing the snake in a way assuring little chance of being bitten. A cornered rattler will naturally coil and get ready to strike, and the boar will start running around the snake in circles, finally jumping upon the venomous serpent until it is literally cut to pieces by sharp-edged hoofs.

While the inroads on deer through the boars' habits of feeding appear negligible, they do affect the population of ruffed grouse, wild turkeys and other ground-nesting birds that inhabit the same area. They invariably devour the eggs of ground-nesting birds when they come upon a nest, and it is not at all unusual for them to catch and eat a bird that attempts to protect the nest. The boars also catch and consume numerous young, ground-dwelling birds.

The Tellico Area is also inhabited by the black bear, which lives off the same foods as the "Rooshian", with the probable exception of young deer and ground-nesting birds and their eggs. While present bear and Russian wild boar populations in the Tellico Area do not warrant any alarm, there is a possibility, providing that both populations increase as anticipated by the game authorities, that future years will see the wild boar seriously competing with the native black bear for food in the region. This is specially true with acorns, mast, and wild fruits.

Hunters are interested in the establishment of the European boar in this country as an additional game species. But some naturalists, and others interested in conservation of our native animal species, do not share their enthusiasm. One wildlife authority holds that the imported wild boar, if allowed to multiply very far beyond its present numbers, would eventually seriously affect other forms of wildlife in the Tellico Area. This man hopes, providing the herd continues to increase as it has done in the past, that authorities will relax hunting restrictions to keep the wild boar in check. Others would like to see this alien species wiped out.

Many gunners find that hunting the "Rooshian" is a thrilling pastime. They come from afar to indulge in this medieval sport in modern form. Beyond getting a trophy, the hunter who kills a European wild boar does not get much. Unless it is a young animal, the flesh is not considered edible. Mounted wild boar heads are widely sought as trophies, but beyond that, there is really not much excuse for hunting them.

Zamboanga Bill

By KEN STOTT, JR.

ORNITHOLOGISTS tell me he should have been called *Buceros hydrocorax mindanensis*, but I found it much more convenient, in the long run, to address him as Bill, Flattop, Hop-a-long, or any of several other names the boys called him. Actually, even "the bird" was sufficient. Anyone in the city of Zamboanga, Mindanao, P. I., asking the whereabouts of "the bird," and there were many who knew him by no more specific a title, could depend on being correctly directed to the Naval Station in which he made his home.

Before acquiring this strange pet, I had frequently encountered wild members of his kind, and had shot a couple for specimens as they fed from fruit-bearing jungle trees. These hornbills are difficult to overlook, in fact. Long before they have come within sight, their sonorous, trumpeting cries can be heard reverberating from one cliff to another in the deep jungle valleys. Then they sweep into view, flying low over the choked forest, their noisy wings beating intermittently. Just like a flock of gigantic black-birds, they swarm about a single tree, alighting to gorge on wild mangoes, or hard little jungle figs. Then, for the first time, one can see clearly the immense, crimson bills for which these birds are famed.

Atop each red, ivory-tipped beak is a large casque looking like an inverted flat-iron. Attacked to the bill is the bird itself—a great, long-tailed creature with broad, short wings. Except for a narrow black mask, its crested head, the nape, and the breast are colored rich chestnut. Its rounded wings are dull brown. To offer contrast, the foot-and-a-half-long tail is creamy white.

The Mindanao brown hornbill, a giant member of the kingfisher clan, is common in the wilder parts of that island. There it may be seen flying either in small groups of its own species, or with large flocks of the smaller white-headed hornbills. Throughout the middle of the day it is quiet and difficult to discover, but early in the morning and late in the afternoon it is much in evidence. The *calao*, as the Filipinos call it, is sometimes known as the alarm-clock bird because the regularity of its early morning calls can be depended upon to summon the workers to the fields at the proper hour. Like most hornbills, this species nests in hollow trees, the male sealing the female in the nursery during the incubation period, keeping her prisoner there until the babies

Mindanao brown hornbills

are hatched and well enough developed to take care of themselves in the great outside.

Bill came into my life early one morning when I was driving the Medical Department jeep through the center of Zamboanga. As I bounced past the Moro market, I glimpsed a droll, gnome-like thing squatting dejectedly on the cement at the corner of the market. Unable to find anything it might use as a perch, it was waddling about on the ground like a misshapen duck. It had apparently done so for some time since its tail feathers had been worn to dusty stubbles. After considerable wrangling with the hornbill's Moro owner, I succeeded in purchasing the bird for an outrageous sum, and, tucking it under my arm, I carried it back triumphantly to the Naval Station.

The ovation he received was anything but a casual one, although some of the remarks he inspired were scarcely of a complimentary nature. However, he was acknowledged an important addition to our growing menagerie, which already consisted of two cockatoos, a pair of Sulu green parrots, three infant long-tailed macaques, and one box turtle. Immediately Bill became the star of the collection. Beside him its other members seemed decidedly commonplace.

As with most pets under native care, Bill had been fed solely on bananas prior to the time we acquired him. It seems surprising that a bird so delicate could have survived on such food for the three months he had purportedly been a captive of the Moro. When Bill came to us, we offered him a bill of fare that

compared favorably with that of any restaurant in town—mangosteen, mango, papaya, pomelo, durian, breadfruit, cooked rice, hard-boiled eggs, canned fruit salad, bread and gravy, lizards, snakes, frogs, salamanders, rhinoceros beetles, six-inch grasshoppers, cicadas, moths and butterflies, all of which he relished. Color played a big part in his food preferences. When offered chopped fruit salad mix, he would carefully select the brighter-colored objects first, eating, in order, cherries, peaches, apricots, grapes and pears. If he were offered more salad than he could eat, the grapes and cubes of pear might remain untouched, but seldom the peaches and never the cherries. His manner of eating insects was remarkable and rather terrifying. When tossed or handed a wiggling grasshopper, he would grasp it gently by the tip of his bill and, with a series of rapid snaps, run it back and forth with machine-like precision, crushing the chitin of its exo-skeleton into a pulp. Only after he had repeated this procedure several times would he attempt, and with a convulsive gulp, to swallow his victim. A six-inch grasshopper is no small bite, the result being that frequently a hindleg would catch on the corner of Bill's beak and the whole mass of crushed insect would dangle in Bill's gasping throat. When, at length, he would succeed in dislodging the offending limb and the last of the grasshopper would disappear, Bill's great eyes would bulge to the bursting point and roll violently skyward. Then blue, long-lashed eyelids would sweep downwards, and Bill would cover his embarrassment with a series of droll ocular flutters.

Bill was, on the whole, an affectionate and responsive pet. He learned quickly to know the faces and voices of those who fed him regularly. Their passing was usually noted with a sad, bugled greeting, which could, with no fear of inaccuracy, be translated at any time of day or night as "Isn't it time to eat?" Bill's appetite was prodigious. As much as he learned to like his caretakers, he never recovered from a dislike of children and dogs, developed, apparently, during his months in the market-place. His loathing of both of these forms of animal life was an active one and neither could approach Bill's cage without risking eyesight. Bill's aim was deadly.

When the time came for my unit to leave Zamboanga, we pleaded desperately with the proper authorities to allow us to bring Bill with us. I had envisioned him as a member of the bird collection of the San Diego Zoo, where I had been employed before going into the Navy. Such a fond hope was doomed, however, for conditions at that particular time made it impossible to transport even the troops ready for return to the States, let alone a great awkward bird like Bill. I gave Bill to Candido, a Chabacano worker on the station, who promised me that Bill would be well fed and cared for. Of that I have no doubt, knowing Candido and his hungry family.

★

Insect Synonyms

By PAUL CHURCHER

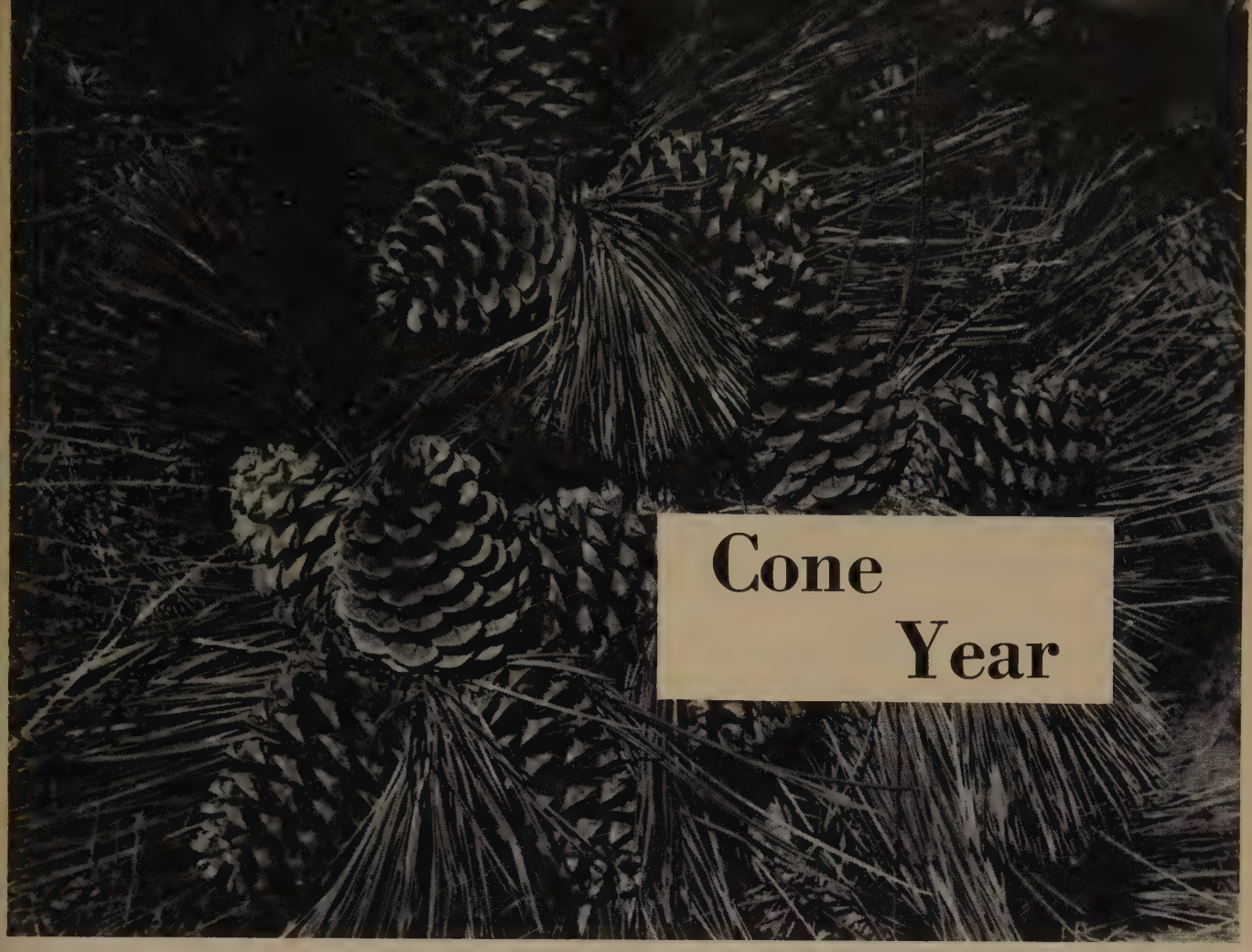
As SHAKESPEARE so aptly commented, you can call a rose by any term you please, but that still does not give it the aroma of wake-robin. The same is true of insects, although, in regard to them, the entomological nomenclators cannot be accused of failing to try. The confusion that results from synonymous common names given to many individual species is surpassed only by the opportunity for a quiz therein contained.

Below, numbered, are listed the accepted common names of eighteen insects. Lettered are eighteen more equally accepted names, *of the same insects!* How well can you match them, letter with number?

Score five for each correctly paired. What? That only totals ninety? Well, go back and pick out the two pairs of names that should never have been included in a list of insects to start with—names, not of insects, but of their near relatives, the arachnids. Five apiece for these will raise the perfect score to one hundred. See page 442 for the answers.

On this test, a high school student made 50, a housewife 65, a college sophomore 75, a professional naturalist 90. Anything higher automatically qualifies you to the rating of Honorary Hexapod.

1. Harvestman	A. Lake fly
2. Punkie	B. Soothsayer
3. Termite	C. Dung beetle
4. Locust	D. Fish moth
5. Praying mantis	E. Masked bedbug-hunter
6. Lacewing fly	F. No-see-um
7. Dragon fly	G. Croton bug
8. Cicada	H. Cootie
9. Aphid	I. May beetle
10. Hour-glass spider	J. Bark beetle
11. Silver fish	K. Daddy-long-legs
12. Cockroach	L. Darning needle
13. Mayfly	M. Short-horned grasshopper
14. Louse	N. Black widow
15. Kissing bug	O. Seventeen-year locust
16. June bug	P. White ant
17. Tumble bug	Q. Plant louse
18. Engraver beetle	R. Aphis lion



Cone Year

By JOHN LINDSEY BLACKFORD

Photographs by the Author

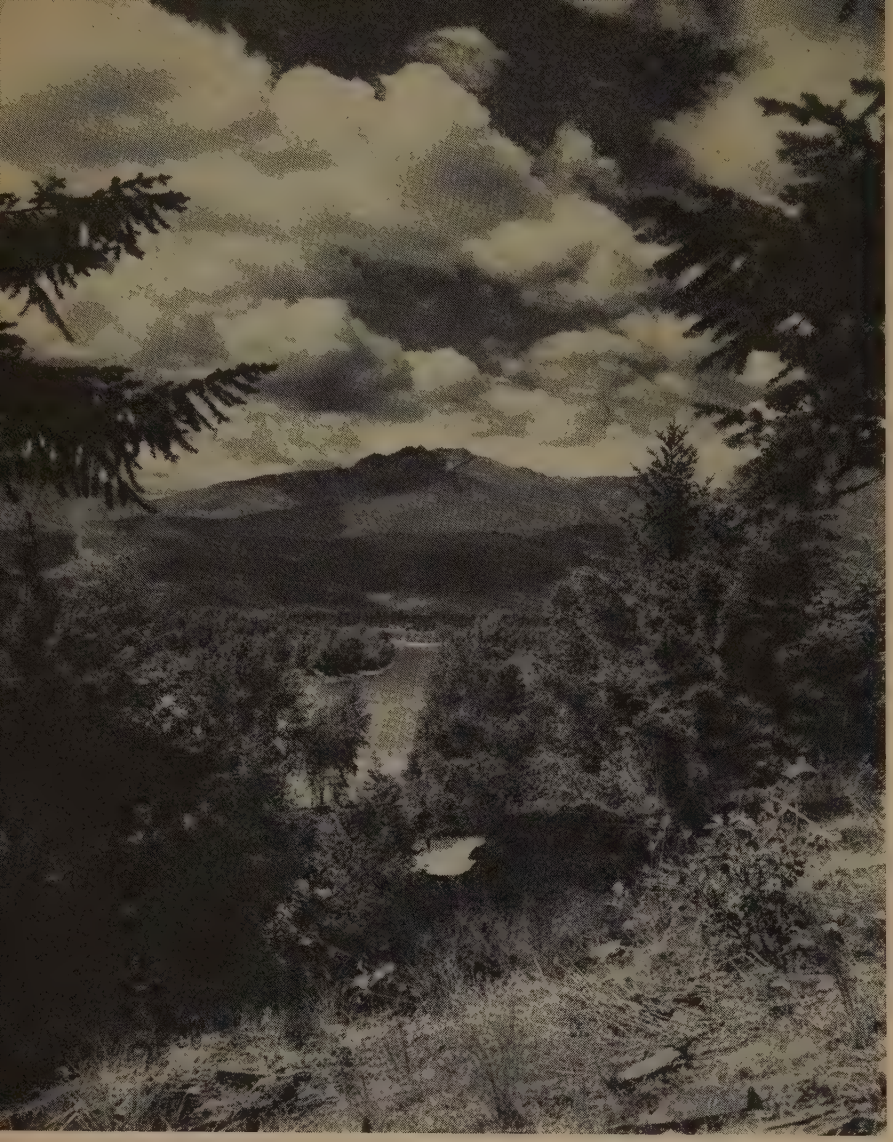
INDIAN Summer's lazy, blue smoke-haze settled low upon the purple hills. Dream-like peace and lassitude pervaded the magic September air. Birches were flaunting only a trim of gold, and osiers showed only an elusive tinge of magenta. Yet the coming heavy harvest among the conifers had already begun on pine flats shelving back from the curving, incredible blue of the swift Kootenai.

"Look out!" shouted my friend, jumping nervously in apprehension at the sound of another heavy thud close behind on the needled forest floor. I was many rods away; yet it seemed to him that I had playfully approached, concealed myself, and was heaving weighty missiles whenever his back turned in my direction. Suddenly a triple cluster of fast-ripening cones, half hidden in the long, redolent needle-tufts of the yellow pine, just missed his shoulder and fell forcefully in front of him. A provident red squirrel, high in the towering ponderosa pine above and unmindful of autumn's seductive summer, was energetically clipping off nut-laden clusters to enlarge his winter stores. Months later, high piles of cone scales and cores, heaped upon snow-blanketed stump or log in bordering fir depths, would testify to the chickaree's foresight and feasting. Unlike my friend, now being pelted by the bountiful conifer crop, he was not forgetting that again it was cone year; he must make the most of it.

Soon frosty October nights freshened the languid valley air. Sun-filled days turned crystal-clear. Tamaracks and aspens flashed sudden gold. A constant patter of falling leaves, as of raindrops stepping lightly, was heard all day in the nearby birchwood.

Out in the open, sunny, pine parks the ripening cone crop again dramatically claimed attention. To meet the rollicking chickadee-nuthatch-woodpecker band is common experience; but in this second week of October I happened upon a veritable holiday convention of the clan, joined there by dozens of other feathered friends—crossbills, kinglets and purple finches.

The usual infectious enthusiasm of chickadees prevailed. Bright-eyed, carefree black-caps swung acrobatically in the long-needled crowns of young yellow pines that bore a first heavy cone-crop. Mountain chickadees—few are ordinarily observed at this low elevation, and seldom early in the season—were already their numerous and sprightly companions. Both species were delving excitedly into open cones, carrying the plump seeds at once to crotch or limb. Here, twisting off papery seed-wings, they hurriedly hammered apart the thin shells to reach plump kernels within. Being skilled insect hunters rather than specialists in nut-cracking, even this light task demanded



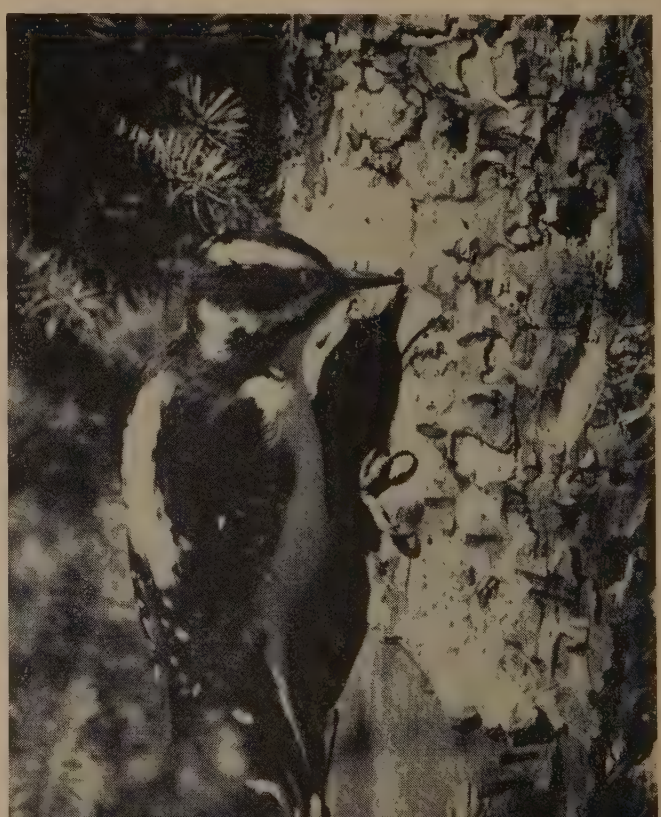
The coming heavy harvest among the conifers has begun on the pine flats shelving back from the curving, incredible blue of the swift Kootenai, and a Rocky Mountain hairy woodpecker was one of the busy company storing wealth.

vigorous effort on the part of the chickadee foragers. They worked with the slippery, rounded nutlets clutched tight by tiny feet, holding them fast in crevices of the rough bark, then struck repeated blows with small, conical bills.

Punctuating their gurgled *tsik-a-dee-dees,* the continuous, high-pitched piping of red-breasted nuthatches came from all about. These bob-tailed midgets seemed just to be hurriedly carrying pine nuts around, stopping only occasionally to extract another from the open, sharply-hooked scales of a russet-cone. From twig to branch, up and down trunk, and on to swaying needle-cluster they flitted in desperate haste and excitement, seed in bill, with little time to feast and never sure of any cache or crevice to which to trust their prize.

"Nutty," the white-breasted Rocky Mountain nuthatch, busied himself storing the harvest. Usually he tried several places before he was satisfied with a crotch, bark scale or crack in or under which to hide his garnered seed. Thrusting it deep in a narrow bark-furrow, he would wedge it tight with sharp, mallet-like blows. Likewise agitated by awareness that sharp eyes would search diligently for his treasure, he would frequently pry the nutlet loose, and try it elsewhere. He, too, appeared in great haste, uncertain how long the bountiful cone crop would last before the gala feasting of his friends. At intervals his seried fluting or penetrating *ank-ank* assured three other white-breasts that he was still hard at work in the locality, rather than drifting on through the moss-draped branches in their customary manner of roaming the pinelands.

One regular member of the troop, however, a female downy woodpecker, was not to be diverted from her usual diligent inspection of the tree-trunks. She bobbed from bole to bole, working over each thick-barked butt near the ground, unmoved by the effervescent spirits of the merry picknickers. But a constant succession of shrill, beady notes, seeming to come from everywhere in the needled greenery, told that an accompanying flock of golden-crowned kinglets shared the holiday, if not the nutlets. Almost wholly insectivorous, they still caught the excitement of the occasion, fluttering ecstatically at the burdened branch tips or swirling in twos and threes through the evergreens.



Occasionally chickadee or nuthatch swung down close among the dead, lichen-decorated lower branches. From here they might scrutinize their observer from different and apparently illuminating angles with beady, bright eyes.

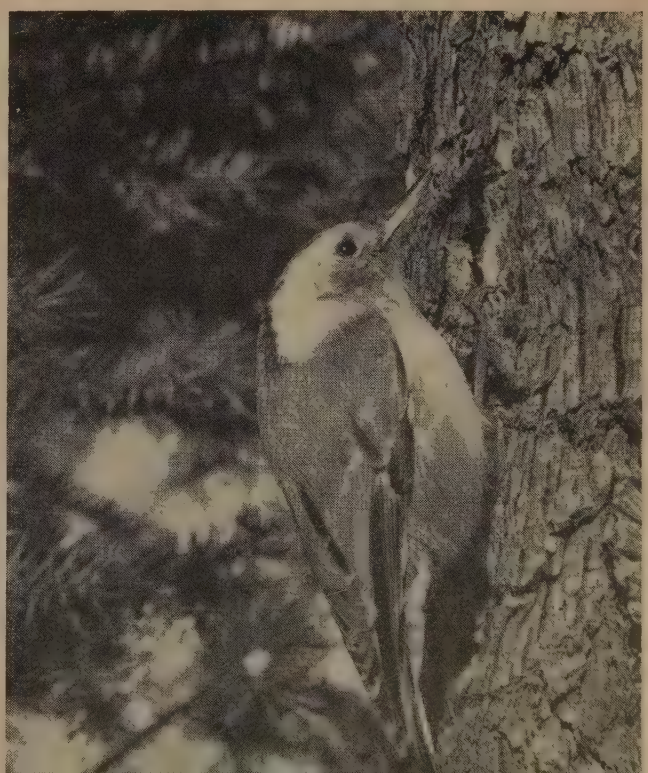
Finally only two crossbills remained, clinging to cones in the high, breeze-tossed needle-tufts of the forest crown. But, after less than thirty minutes, the entire company returned. Insistent, reedy pipes of nuthatches and thin notes of kinglet and chickadee announced the band before its talkative arrival. The crossbills came swiftly, their freer flight being through or above the treetops. Again the carnival among the cones was reenacted, with the difference that five Clark's nutcrackers flew noisily over.

This, too, was manifestation of the limitless bounty offered by the pines. These raucous pine crows now were more abundant in the lowlands than for a score of years past. During many a season not one had been glimpsed on the river flats, the sturdy mountaineers keeping to high strongholds, chiefly at timberline. On every roadway avenue through towering ponderosa or fir-tamarack fastness, their white-patched pinions were constantly flashing as they

A provident chickaree was energetically enlarging his winter stores with the largess of the laden conifers, and the white-breasted Rocky Mountain nuthatch busied itself with the harvest, trying various spots in bark or crack to hide the seed.

Upon all this festivity fell a quite steady rain of twirling seed-wings from high crowns of the taller pines. There the efficient crossbills, performing like feathered seed-mills, emptied the ripened cones, shed each kernel of shell and wing, and dominated the lively small talk coming up from below by their sharp, "pinking" call notes. Striving to observe their "processing" of the pine seeds, I swept the glasses from cluster to cluster until the bright field of view encircled two birds upon a single cone—one in the dull vermilion of a male crossbill, the other clinging at his side and feeding with him, clad in the rosy purple of a friendly purple finch! Both were feasting happily.

Presently the more volatile kinglets disappeared toward spired firs clumped densely on the hill. Soon downy woodpecker followed, although her kind are commonly laggards among these companionable feathered folk; for woodpecker investigations go beneath the bark, and there are many situations that need prying into. Their friends, who are habitually on the move, stayed an unusual hour in the pines.



crossed before the car to mount into the cone-clustered roof of the forest. Their clamorous, rasping cries again were nostalgic reminder of matted wind-timber and gale-combed crag, of ice-sharpened arête and boulder-piled moraine. Now, with October's bumper harvest, they were flocking in legion down among our sun-bathed yellow pines!

During the warm, blue-sky days that followed, I watched the silver-gray nutcrackers plundering the stout pine cones. Theirs was not the dextrous attack of the crossbills, whose clipper bills expertly pried prickly scales apart that scoop-like tongues might be inserted to secure the seed. Instead the pine crows forcefully hammered upon the opening scales, thrust long, powerful, pick-like mandibles deep in between and toward the core of the cones, extracting the prized nutlets. They seemed usually to twist off the seed-wing as they drew the pine nut forth, and with the same motion raised their bills and gulped it, kernel, hull and all. These big, husky visitors astride the heavy, swaying cone-clusters were a never-ending thrill in the pine parks; and the redolent aisles daily resounded with their rasped *cha-a-a-a* and piercing *keeeer.*

Mid-October brought recruits to the rollicking banqueteers among the conifers. A new note, enchanting in its breezy sweetness, recalled the romping summer flocks of linnets—*zeeeeee-zeeeeee,* it was the pine siskins! They were taking seeds from tiny cones of the single cedar in these woods, swinging upon the springy branch tips with all the abandon of their cheerful cousins, the migrant redpolls. Their numbers spilled over into nearby giant tamaracks, where they were soon joined in feasting amid midget tamarack cones by enthusiastic crossbills—symbols anywhere that cone year has come to that particular land.

Purple finches, autumn partners of the crossbills, had departed; now the latter were quick to form a new allegiance with the finch's confiding, smaller friends, these dusky-streaked "northern canaries."

November drew the gleaming snow-mantle crowning the range down into our valley foothills, and misted the scintillant peaks. On its chill first day I found the crossbill and siskin flocks together on the hill. The siskins' wheezy, indolent notes and sweet twittering descended musically from the mighty tamaracks, while the crossbills—dull scarlet males and saffron-yellow and gray females—were scattered among them as well as in greater numbers on heavy-laden Douglas firs and occasional yellow pine.

As the incessant chatter of the revellers reached its height, a hairy woodpecker mounted diagonally up the timber slope just over the leafless undercanopy of the wood, loudly shouting his sharp *peek.* His long, up-sweeping bounds brought him swiftly into the midst of the company. And without hesitation he sped to the huge underbranches of a gnarled pine; then to a triple cone-cluster among a dozen industrious crossbills. Without discernible notice they accepted the big, jovial fellow in black-and-white dress suit and poppy-red nape patch as one of themselves. In short flights the master woodsman moved from cone to cone, until at leisure he had deftly rifled six of their ripened kernels. Then dropping from his prickly perch, in one long diving flight he descended the hill slope, continuing on eastward as he had come.

I followed, and discovered that he had joined another hairy and two downies in dense birch and fir at the foot of the ridge. Quite obviously this jolly fellow had a taste for pine nuts, and, hearing the crossbills, had come up to join them for a snack. Then, although they were now more than 200 yards beyond, he had detected the tree tapping of his woodpecker friends, and in swift, precise flight rejoined his own party at the point to which it had progressed along the base of the wooded hill, reporting on his digression.

December trimmed the forest with glittering white. January continued the revel among the conifers. As light snowfall and sunshine alternated, a new, joyous flock-note from boughs of the tamaracks signaled other light-hearted, mid-winter visitors. In the deep, hill woods about thirty pale goldfinches hung in one giant larch top; they seemed to cascade slowly in fluttering descent as they worked down to the cones of the lower branches. The males, of course, had doffed their black caps and bright gold for winter plumage closely matching (Continued on page 442)

Thesis Metrical

By PAUL CHURCHER

Autumn's smouldering blaze of brilliance
Spread in riotous display
Botanists explain quite simply . . .
In a scientific way.

Frost, to whom the layman falsely
Credits this prismatic pageant,
Actually is little more than
Color's catalytic agent.

Nature puts no torch to hillsides,
Sets no floral conflagration;
Skillful analytic research
Proves it's chemical elation.

After summer green has vanished,
Due to lack of chlorophyll,
Yellow brews a potent potion—
Carotin and xanthophyll.

Red, alias anthocyanin,
(Purple if in alkaline medium)
Decomposed by oxidation,
Fades to brown's fatiguing tedium.

All those fires of gold and scarlet
Are at best but flaming figments
Of the mind and done with mirrors.
Every hue is caused by pigments.

Yes. But, Botanists, I wonder
If your cold hearts ever stole
With outstretched memories to Autumn's
Glowing hearth to warm the soul?

Birds of Shakespeare

The peregrine falcon appears on the crest of Shakespeare's coat-of-arms.

By L. McCORMICK-GOODHART

Illustrated by Robert Barker

THE English are, perhaps, the greatest of all bird lovers; have been so, at least from the times of Chaucer. Birds are infinitely more beautiful in other lands, and they sing just as sweetly elsewhere. But this love, I believe, springs from the Englishman's individualism, and also from the consummate faith in the wonders of the Creation that possess the average Briton. The Englishman is not prone to share his individual troubles with others. He must, therefore, have something within to keep up his courage, to support him in his hours of meditation and distress. That something is, above all, his love of Nature.

". . . his eye, as bright as is the eagle's, lightens forth controlling majesty."

The most conspicuous and most comforting feature of Nature is—not even excepting the hills and dales and flowers—her bird life. The birds give movement to the loveliest designs of Nature. By their songs they make Nature expand her ecstasy. What, indeed, more beautiful than spring in the English countryside—green, rolling fields and bursting fruit-blossoms, ripening hedges, the yellow primroses and bluebells carpeting the woods, the first old English flowers blossoming in the countless little gardens!

The countryside of England was like this in April, 1564. On the twenty-third of that month, at Stratford-upon-Avon, William Shakespeare was born, and there he spent his years until at least the age of twenty-two. If William resembled other boys he would have been birds-nesting by the age of ten. There was no dearth of birds in the lovely, undulating country around Stratford, and close at hand were the homes of hedge-sparrow in the briars, robins and thrushes in the bushes, pigeons and rooks in the trees, skylarks in the fields.

Shakespeare, with his omnivorous appetite for knowledge, must have known all these birds. The flight and song of the players of the air must have inspired his musing, and it is not surprising that, years later, he should turn for illustration, both factual and metaphorical, to the birds of his youth.

If one is to be sternly statistical, he will find that Shakespeare's references to birds reached the amazing total of 650. The wild birds that claim the most references are the crow, lark, eagle, cuckoo, kite, dove, raven and owl. The actual species of wild birds mentioned number fifty-one, all common species of the poet's day. He was no ornithologist and did not go in for varieties, but he had an uncanny knowledge of the habits of many birds, and of the legends, arising from these habits, that had been handed down through generations.

Turning the pages of Shakespeare's works, we find that the author always refers to the eagle in a generic and metaphorical sense as the emblem of majesty. *Richard II,* Act III: "Behold, his eye, as bright as is the eagle's, lightens forth controlling majesty." *Cymbeline,* Act IV: "I saw Jove's Bird, the Roman Eagle, wing'd from the spongy South to this part of the West . . ."; and, again, in Act V: ". . . the holy eagle stooped . . . his ascension is more sweet than our blest fields." In *Titus Andronicus,* Act IV: "The eagle suffers little birds to sing, and is not careful what they mean thereby, knowing that with the shadow of his wing he can at pleasure shut out their melody." The wide-ranging golden eagle is the bird that the bard had in mind.

"I think he'll be to Rome as is the osprey to the fish . . ."

". . . kites fly o'er our heads and downward look on us as we were sickly prey."

Of other large birds of prey, Shakespeare mentions four—the vulture, osprey, kite and buzzard. The vulture is one of the few foreign birds that find a place in his works, and he knew well its scavenging habits, as in *Henry IV,* Part II, Act V: "Let vultures vile seize

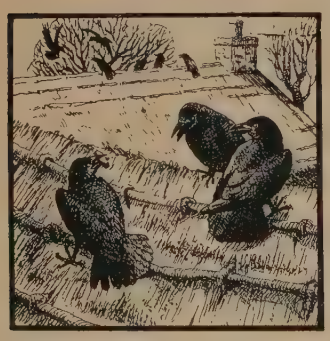
on his lungs also," a dramatic if not a pretty line.

It is pleasing to see that Shakespeare was well acquainted with the osprey. I have watched it many times in St. Mary's County, Maryland, sailing over the Patuxent River and plunging for fish, and there is no more beautiful and friendly bird. In *Coriolanus*, Act IV, the playwright says: "I think he'll be to Rome as is the osprey to the fish, who takes it by sovereignty of Nature." The osprey of Shakespeare, now all but extinct in England, is the same as the American bird.

"The owl by day, if he arise, is mocked and wondered at."

The kite is a great rarity in Britain today. A lazy scavenger, it used to be common over London. Says Cassius, before the battle in *Julius Caesar*, Act V: "And in their stead do ravens, crows, and kites fly o'er our heads and downward look on us as we were sickly prey." The bard also referred to the bird as the "puttock."

Birds trained for falconry were the peregrine falcon and the goshawk, the former the familiar duck hawk of America. The falcon was of special interest to Shakespeare because it was included on the crest of the coat-of-arms for which he applied successfully to the College of Heralds in London. The family of the poet's mother—the Ardens—were gentry and bore arms, and John Shakespeare, the bard's father, had made application for a coat but dropped it. So when William was at the height of his career he felt that his wealth and position, in addition to his descent, entitled him to a coat-of-arms. The official grant describes the crest as: "A falcon with his wings displayed, standing on a wreath of his colours, supporting a spear armed, headed and steeled silver."



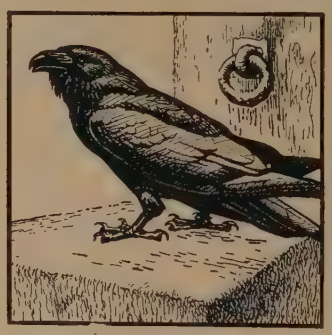
The rook, though common, is noted only once by the bard.

In addition to the falcons, Shakespeare refers to two other small hawks, each on one occasion — the kestrel, known to him as the "starniel," and the sparrow hawk, the male of which was known as the "musket" in the bard's day. Hence, in *The Merry Wives of Windsor*, Mrs. Ford addresses Falstaff's page, saying: "How now, my eyas-musket?" The word "eyas" means a nestling.

By the people of Athens, the owl was regarded with veneration, but the Romans first looked upon it as a bird of ill omen. Thus, to Shakespeare, the owl was an "obscene", "ominous", "fearful", and "fatal" bird of night. At the time of the murder Lady Macbeth says: "Hark! Peace! It was the owl that shrieked," and, later, "I heard the owl scream." In *Henry VI*, Part III, Act V, the reference to the owl is: "The owl by day, if he arise, is mocked and wondered at." In the same act, the king addresses Gloucester, saying: "The owl shrieked at my birth, an evil sign."

Shakespeare alludes several times to the "screech-owl", taken to be another name for the English barn owl. One of the charming allusions to this bird is Ariel's song in the *Tempest*, Act V: "Where the bee sucks, there suck I; in a cowslip's bell I lie, there I couch when owls do cry."

In England the crow family is more interesting than in America. Britons have the carrion crow; a two-colored hooded crow; that amazingly congenial bird, the rook; the mischievous jackdaw; the cliff-dwelling chough, and the noble raven. From the earliest days the raven, with his deep and solemn voice, has commanded attention. In *Troilus and Cressida*, Act V, Thersites says: "Would I could meet that rogue Diomed; I would croak like a raven." In *Othello*, Act IV: "It comes o'er my memory, as doth the raven o'er the infectious house, boding to all." Lady Macbeth observes: "The raven himself is hoarse that croaks the fatal entrance of Duncan under my battlements." *Titus Andronicus*, Act II, gives us: "Some say that ravens foster forlorn children the whilst their own birds famish in the nest." There are many other references to this bird throughout the bard's works; some of them contrast it with the dove as an emblem of purity, and in *Romeo and Juliet* we read: "whiter than snow upon a raven's back."



". . . as doth the raven o'er the infectious house, boding to all."

Shakespeare makes frequent allusions to the crow and its desire for carrion; for example, in *Henry V*, Act II: "BOY: Mine host Pistol, you must come to my master, he is very sick. HOST: By my troth, he'll yield the crow a pudding one of these days." Crow color is mentioned in *Winter's Tale*, Act IV: "Lawn as white as driven snow, cyprus black as e'er was crow." "Cyprus" was a sort of black crepe. Beatrice, in *Much Ado About Nothing*, declares: "I had rather hear my dog bark at a crow than a man swear he loves me."

The chough, now rare, inhabited the white cliffs of Albion around Dover in the time of Shakespeare. In *King Lear*, Act IV, we find: "Come on, Sir; here's

the place—stand still—how fearful and dizzy 'tis to cast one's eyes so low. The crows and choughs, that wing the midday air, show scarce so gross as beetles." The word "chough" is also found applied to persons, Falstaff thus characterizing his traveler victims at Garshill.

The mischievous jackdaw is not so frequently mentioned; only six times, and always as the "daw." It appears in *Henry VI*, Part I, Act II: "But in these nice sharp quillets of the law, good faith, I am no wiser than a daw."

The rook, common as it must have been, meets with little recognition. It is noticed in the song in *Love's Labour Lost*. Two other birds of the same family are the magpie and the jay. Shakespeare calls the former the "magot-pie," or, simply "pie." In *Henry VI*, Part III, Act V, we find: "And chattering pies in turmoil discords sing." As to the jay, *Taming of the Shrew*, Act IV, yields: "What, is the jay more precious than the lark because his feathers are more beautiful?"

The carrion crow is one of the crows mentioned by Shakespeare.

A word must be said of Shakespeare's use of the word "night-raven," or "night-crow." This evidently refers to a beautiful bird of a different character — almost extinct in Great Britain, but fairly common in America — the bittern. "The night-crow cried, aboding luckless time." *Henry VI*, Part III, Act V.

Shakespeare did not ignore the birds of song; the "light-wing'd Dryads of the trees." Of all singers in the avian choir the nightingale stands first. In the works of the bard this famous songster is also known as Philomel, from its Latin name. All know: "It was the nightingale and not the lark, that pierc'd the fearful hollow of thine ear; nightly she sings on yon pomegranate tree; believe me, love, it *was* the nightingale." This is a most interesting passage, for it reveals the poet's wonderful general knowledge, and that he could err. The nightingale does sing in pomegranate groves in the Near East, but "she" never sings; "he" does. Again, from *Midsummer Night's Dream*, we have: "Philomel with melody, sing your sweet lullaby." Charming is the line in *Two Gentlemen of Verona*, Act III: "Except I be by Sylvia in the night, there is no music in the nightingale."

Chaucer, Spenser, Milton, Shelley and Wordsworth shared with Shakespeare adoration for the skylark. In *Winter's Tale:* "The lark that tirra-lirra chants"; in *Romeo and Juliet:* "It was the lark, the herald of the morn"; in *Cymbeline:* "Hark! Hark! The lark at Heaven's gates sings, and Phoebus 'gins arise"; in *Love's Labour's Lost:* "When shepherds pipe on oaten straws and merry larks are ploughmen's clocks." In *All's Well that Ends Well*, a similar bird, the bunting, is noticed with: "I took this lark for a bunting."

The thrush, or throstle, with the missel thrush and blackbird, represent a family of which we have, in America, several beautiful singers, such as the veery, hermit thrush and thrasher. Only three passages from Shakespeare pay this group tribute. In *Midsummer Night's Dream*, Act III, Bottom, the weaver, sings of "the throstle with his note so true." In the same play the blackbird is called the black ouzel in the line: "The ousel-cock so black of hue, with orange-tawny bill."

"Lawn as white as driven snow; cyprus black as e'er was crow."

Familiar robin-redbreast was known by the name "ruddock," a term still used, and derived from the ruddiness of its breast. In his reference to the robin, the poet refers to the old notion that this bird covered the dead with flowers. In a beautiful passage in *Cymbeline*, Shakespeare, writing of Fidele's grave, mentions several flowers, and continues: "The ruddock would with charitable bill bring thee all this." Often associated with the robin is the wren, but Portia is not enthusiastic for this little bird when she says: "I think the nightingale if she should sing by day when every cock is cackling, would be thought no better musician than the wren."

There are many references to the sparrow, two varieties of which must have been familiar—the English house-sparrow and the hedge-sparrow. In Shakespeare's day the sparrow had a nickname, "Philip." In *King John*, Gurney says, "Good leave, good Philip," and the reply is an indignant "Philip! Sparrow!" In *Tempest*, Act IV, Iris tells us that Cupid "swears he will shoot no more, but play with sparrows." In *Henry VI* is a famous passage: "PRINCE HENRY: He that rides at high speed and with his pistol kills a sparrow flying. FALSTAFF: You have hit it. PRINCE HENRY: So did he never the sparrows." The fool in *King Lear* definitely refers to the hedge-sparrow as feeding the young, parasitic cuckoo in her own nest, and in *Lucrece:* "Why should hateful hatch in sparrow's nests?" Search will reveal other sparrow lines.

"It was the lark, the herald of the morn," said Romeo.

The poet makes only one allusion to the little wagtail, sometimes called the dishwasher, and that opprobrious, for Kent in *King Lear* says: "Spare my gray head, you wagtail!"

Pigeons and doves come in for considerable attention, but largely the domestic varieties. In *Henry VI*, Part I, Act II, we find: "when arm in arm they both came swiftly running, like to a pair of loving turtle-doves." In *Troilus and Cressida:* "As true as steel, as turtle to her mate."

"The ruddock would with charitable bill bring thee all this."

Among the game birds we find only one reference to the pheasant, in *Winter's Tale:* "THE CLOWN: Advocate's the court word for a pheasant: Say you have none. SHEPHERD: None, Sir; I have no pheasant, cock or hen." The reference is of interest since the pheasant was an exotic bird, introduced into England many centuries before, probably by the Romans.

The partridge gains attention in *Henry VI*, Act III: "Who finds the partridge in the puttock's [kite's] nest, but may imagine how the bird was dead." Of quails, Antony says to Caesar: "his quails ever best mine."

Shakespeare makes allusion to a well-known habit of the lapwing, otherwise called the peewit, wype or green plover, and corresponding in habits to the killdeer plover that greets us so frequently in America. This habit is that of trying to draw people away from the nest, and, in *Comedy of Errors*, Act IV, we find: "Far from its nest the lapwing cries away."

The cuckoo is used in the bard's plays frequently.

Hamlet, Act II, yields a reference to the heron by a version of its old name of "heronshaw": "I am but mad north-north-west; when the wind is southerly I know a hawk from a handsaw." This latter expression is still used in parts of New England, where, also, the word is corrupted into "handsaw." The heron of the bard's day was considered a table delicacy.

Other game birds familiar to the poet were the woodcock and snipe. *Taming of the Shrew*, Act V, indicates that the woodcock was supposed to be a bird of no brains, and the line goes: "O this woodcock! What an ass it is!" There are several notices of this bird in traps, as in *Twelfth Night*, Act II: "Now is the woodcock near the gin." The snipe comes in for one allusion, in *Othello*, Act I, where Iago says: "For I mine own gained knowledge should profane, if I would time expend with such a snipe, but for my sport and profit."

In Shakespeare's time there was much "ducking," but it consisted of hunting a tame duck in the water with spaniels, or a wild one with a "birding-piece," a sort of primitive musket. Even decoys were used, and called "stales." For the most part the poet used "duck" or "wild-duck" in a generic or metaphorical sense, but we once find "mallard," in *Antony and Cleopatra*, Act III: "Like a doting mallard, leaving the fight in height." In *Tempest*, Trinculo exclaims: "Swum ashore, man, like a duck; I can swim like a duck, I'll be sworn." In *Henry VI*, Part II, we read something that might be said today: "Believe me, had not your men put up the fowl so suddenly, we had had more sport!"

There are frequent allusions to wild geese. Puck compares the frightened varlets who fled at the sight of Bottom with the ass's head to "wild-geese that the creeping fowler eye." The fool in *King Lear* points out that "Winter's not gone yet, if the wild-geese fly that way." Metaphorically, in *Romeo and Juliet*, Act II, Mercutio says: "Nay, if our wits run the wild-goose chase, I am done; for thou hast more of the wild-goose in one of thy wits than, I am sure, I have in my whole five."

The poet mentions one specific variety of goose once, the barnacle goose which, it was anciently believed, and with great conviction, was generated from the common barnacle of ships. Although there are many references to swans and cygnets, it does not appear that they ever treat with the wild birds. The loon is used only in the metaphorical sense of coward. Of the related little grebe, the "dive-dapper," Shakespeare says in *Venus and Adonis:* "Like a dive-dapper peering through a wave, who, being looked on, ducks as quickly in."

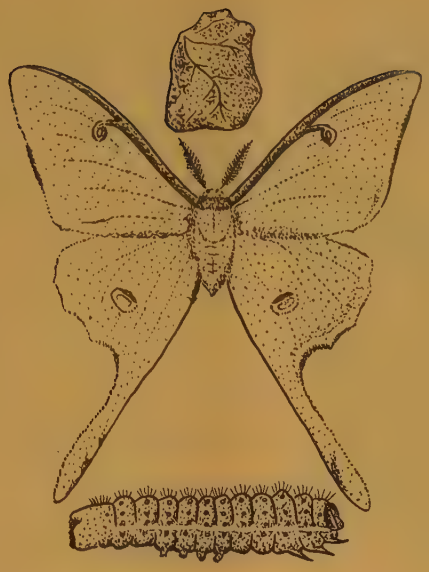
The bard of Avon was familiar with the voracity of cormorants, at least by name and reputation. The "insatiate" cormorant is referred to in *Richard II*. In *Coriolanus* we hear of the "cormorant belly"; in *Troilus and Cressida* of "this cormorant war"; in *Love's Labour's Lost* of "cormorant-devouring time." Oriental practices of fishing with cormorants prevailed in England in the time of James I, and there was even a "Master of the Royal Cormorants."

The gull, variously termed "sea-mall," "sea-mell," or "sea-mew," is used largely to signify a fool. In *Twelfth Night* Fabian declares: "Here comes my noble gull-catcher." He apparently means a "sharper," but in *Tempest*, Act II, the bird itself is meant in the line: "Sometimes I'll get the young sea-mells from the rock."

Kingfisher, swallow and martin come in for reference by Shakespeare, but he ignores such birds as the warblers, or titmice, and there is no mention of the woodpeckers, unless reference to "wood-birds" is meant for them.

(Continued on page 444)

LARVAL, PUPAL AND ADULT STAGES OF CABBAGE MOTH (ABOVE), LUNA MOTH (RIGHT), AND RED-SPOTTED PURPLE BUTTERFLY (RIGHT).



This is the forty-first in Nature Magazine's series of educational inserts.

Some Butterflies and Moths

By E. LAURENCE PALMER

Illustrated by E. M. Reilly

WHEN LORD Byron wrote, "Maidens, like moths, are ever caught by glare," he could have had no possible concept of the drawing power of The Great White Way. He apparently did know that light attracts moths of some sorts, but if that was all he knew of them he only scratched the surface of a tremendously interesting field of Nature. His dilettante concept of the moth was more pleasant than the Bible's association of moths with rust in producing corruption, and so many writers have commented on the "silly moths" that are proverbially singed by the flame that it seems appropriate to find something of the truth about these tremendously interesting insects.

The entomologists, or insect students, tell us that moths and butterflies belong to one great order, the Lepidoptera, and our teachers like to show their erudition by explaining that this $64 word means scaly-wings. Anyone who has ever caught a moth or butterfly in his hands has discovered this character of the wings. Some concept of the relative importance of the group among the insects is indicated by the fact that approximately one-fifth of the insects known from New Jersey are members of this order, and a catalog of the lepidoptera of New York State requires between 600 and 700 pages of fine print. Under these circumstances, we cannot here attempt to treat the group exhaustively, but, with apologies to some of our good lepidopterist friends, will attempt to provide a nodding acquaintance.

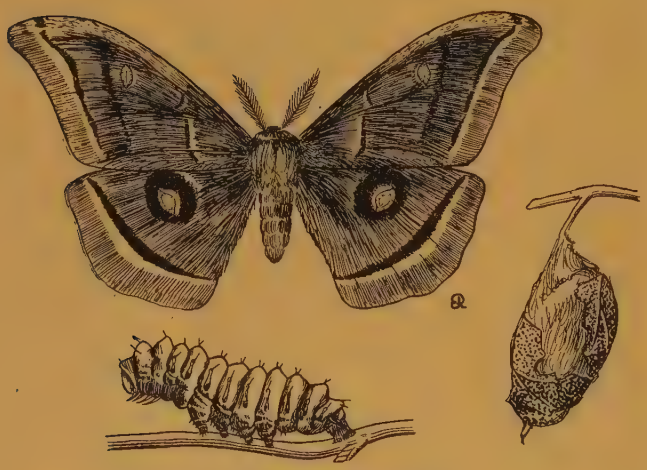
I once wrote of these insects as belonging to the secret order of lepidoptera, in which there were four degrees through which the candidates for the final regalia went. These degrees began with the egg. The second degree was represented by the larva, or caterpillar. In the third degree—the pupal stage—the changes that took place were even

TIGER SWALLOWTAIL

VICEROY

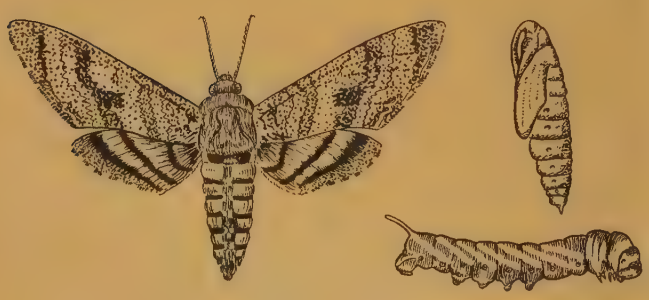
IO MOTH

MONARCH BUTTERFLY



POLYPHEMUS MOTH

CLOUDED SULPHUR BUTTERFLY



SPHINX MOTH

greater than the changes that may take place in testimony when a prisoner is given the third degree. In the final, or fourth degree, the novitiates became full-fledged members of the order and were given appropriate regalia to testify to their success. The spangled covering of a moth and butterfly often far excels in beauty anything that man, with the help of science, can create, and it is this spangled raiment that intrigues so many amateur and professional naturalists.

The Egg. If moths and butterflies laid eggs the size of hens' eggs, we might raise them commercially to eat. But, if they did, the chances are that the caterpillars would be so huge that they would destroy all the plants we need for food. Since there are thousands of different kinds of moths and butterflies, it is not strange that the eggs of these animals, and the manner in which they are laid, vary greatly. Some moths may lay their eggs in flight, letting them fall wherever they may. Others help their young to survive by at least laying the eggs on a plant that may provide a suitable food supply. Still others, like the tent caterpillars of our apple and cherry trees, lay eggs in a compact, waterproofed mass on the part of a particular kind of tree that will produce fresh young leaves at the very time the eggs hatch into voracious caterpillars. While these eggs may winter over, some other lepidoptera may spend the winter just as safely in other stages.

Possibly one of the most selective placings of a butterfly egg takes place with the wanderer butterfly. The female places the egg in a mass of aphids or plant lice to provide meals for the growing wanderer butterfly caterpillars. There must be considerable seeking out of a proper place to lay the eggs. In the chart material that accompanies this article are brief descriptions of some of the eggs of the members of the group. Some of these eggs may be recognized by the color of the gum used to attach them to their support; others by shape or size; still others by color or position.

The Caterpillar. In this early stage of a moth or butterfly, it is essential to increase rapidly in size, and somehow to avoid as many enemies as possible in the process. Since about the only way to grow is to consume great quantities of food, this stage is usually one prolonged eating spree. In the midst of this orgy, the caterpillars stop now and then to let out their belts. Since, like all other insects, they carry their skeletons on the outside of their bodies, they must shed the skeletons, and grow some new ones big enough to provide room for the food eaten on another spree. The number, or frequency, of these changes varies with the different insects, and, in some cases, with the opportunity to gorge continuously. Life to a caterpillar is just one grand banquet after another—or it is death.

With the caterpillars of moths and butterflies, many become independent of their own kind as soon as they hatch from the egg; others stick together in spite of the fact that such crowding results in serious competition for food supply. Those that do crowd, or remain together, provide some interesting observations. Some feed in unison. Some assume a threatening post in concert. Many cooperate in the construction of a common shelter, as in the case of the apple-tree tent caterpillars.

Some of the control measures we adopt in our war

against destructive lepidoptera are based on knowledge we have of the habits of their caterpillars. For example, it is futile to destroy a tent caterpillars' nest when the insects are feeding away from home. It is better to wait until evening, or until some rainy day when the nest will be crowded. Then a twist of a wire brush in the nest, followed by a dunking in kerosene, will destroy great numbers of the pests and not injure the tree.

Not a few caterpillars leave silken trails behind them as they move about. We cannot, with much degree of confidence, presume to say why. It would seem as though this provided a guide for a return trip, but this is not necessarily so. Some enemies are known to lie in wait along these silken trails to attack the returning animals, but whether this is instinct, intelligence or accident is difficult to say.

Many of our methods of attacking an enemy are based on knowledge of eating habits. The way to a man's heart may be through his stomach, and the way to a caterpillar's grave may be by the same route, but, to get to the stomach, food or poison must get through the mouth, if the poison is a stomach poison. It happens that all of our caterpillars chew their food, so control measures are largely effected by placing surface poisons where they will be taken up with the food as it is eaten. Paris green and similar poisons are commonly used in this way.

A rather surprising variation exists in the time of day when caterpillars feed. Some of the cutworm pests of the garden forage among our choice vegetables at night, while many caterpillars take to shelter with the first suggestion of darkness. All this is taken into consideration in planning any necessary campaign against them.

When a caterpillar has reached its maximum development, it prepares for the next stage. If this is underground, the caterpillar may, like many cankerworms or measuring worms, drop from the treetop where it has fed, and, with the help of silky thread, reach the ground in perfect safety. If the next stage is spent as a naked pupa, as in the case of the butterflies, surprising changes take place in the shape and pattern of the outer surface. If the pupa is to be encased in a silken cocoon, the caterpillar may cease eating and move about nervously in search of a suitable place to make its own silken bed.

The Pupal Stage. Earlier in this account we mentioned the remarkable change that took place in the normally third stage in the life history of a moth or butterfly. In this pupal stage phenomenal changes take place. An animal of special characteristics becomes, in a relatively short time, another animal of radically different nature. It is not surprising that, during this period, the most effective protection is retirement to some hidden place. As already suggested, some achieve a degree of protection by preparing a weatherproof cover of silk. Frequently this is camouflaged by leaf fragments; sometimes even covered with a curled leaf. Wooly bear caterpillars rest in a covering made largely of the "wool" that covered the original caterpillar. Not a few caterpillars, like the tomato worms and the cankerworms, burrow into the ground, where they make the change of a

(Continued on the last page of this insert)

WHITE ADMIRAL BUTTERFLY

PROMETHEA MOTH (FEMALE AND MALE)

MOURNING CLOAK BUTTERFLY

BLACK SWALLOWTAIL BUTTERFLY

COMMON NAME SCIENTIFIC NAME	POLYPHEMUS MOTH *Telea polyphemus*	IO MOTH *Automeris io*	LUNA MOTH *Tropacea luna*	PROMETHEA MOTH *Callosamia promethea*
DESCRIPTION	Wingspread: to 6 inches. Wings: at rest, held over the back, like butterflies. Male: fore wing; buff, olive or gray-brown, with transparent, yellow-bordered eyespot; hind wing: with dark border, and black eyespot, deeply black-bordered. Female: much like male, but with heavier body, and with antennae, not broadly feathered. Nocturnal.	Wingspread: to 3 inches. Adult holds wings like sloping of a roof or thrown back. Male: with yellow fore wings. Hind wings: yellow, and brilliant red, with a great eyespot in center of each. Antennae: broadly feathered. Female: fore wings, dull purple to brown; antennae, not feathered.	Wingspread: to 5 inches. Fore wings: thrown back in repose. Males: beautiful, pale green moths, with small dark eyespots, on each wing; hind wings, with extraordinarily developed tails; antennae, broad. Females: with narrower antennae, and much heavier bodies, than their mates. Nocturnal. Rarely fly until near midnight. Found in May and June.	Wingspread: to 4 inches, with wings held erect over back. Male: diurnal, black, with clay-colored borders, and blue eyespots near tips of fore wings; antennae: nearly twice as wide as in the female. Female: nocturnal, light brown, with inner half of each wing darker; distinct eyespot near tip of fore wing and light dash on inner half of hind wing.
RANGE	Common throughout the United States and in northern Mexico wherever its food is available.	Common in North America east of the Rocky Mountains, and in northern Mexico. Seen as adults most commonly at night. The family includes 34 species. This is a common eastern species.	Common, but never abundant in the ordinary sense. In general, limited to the area where its food plants, mostly trees, may be found.	Common and widely distributed wherever its cosmopolitan food plants are to be found.
REPRODUCTION	Over 300, cream-colored, disc-like eggs with brown bands, usually on under leaf-surface, hatch in 10 to 12 days, into caterpillars that finally are green, with reddish heads, conspicuously segmented, with rose-red, or pale prickles, and silvery tubercles, and bright red spiracles, and 7, oblique, yellow lines on sides. Walking caterpillars may snap their jaws so hard as to be heard. Pupa: in thick, strong, light colored, oval cocoon, over winter.	Eggs: white, with a black spot, top-shaped, laid in cluster of 20 to 30, on leaves, hatch in about 10 days, into red-brown at first, then yellowish, then, bright green with red and white striped, social caterpillars, that draw together in masses when disturbed, or walk in processions. Pupae: in thin, irregular, brown cocoons, on the ground, over winter.	Female may lay as many as 200 pure white eggs, fastened with reddish cement to twigs and upper leaf-surfaces. These hatch in about 3 weeks into clear green caterpillars, with faint continuous lines over the back from the sides. Larva molts at end of 4, 7, 9, 10 days, and spins, 18 days later, a thin, leaf-covered cocoon for the wintering pupa. May be 2 generations a year.	Eggs: small, white, depressed, oval, fastened, with red cement, to under leaf surfaces, many in a cluster, that hatch in a few days. Larva: 1st, banded, yellow and black; mature, 2 inches long, smooth, clear, light green, with 6 rows of tubercles, with bluish circles around them and 1 yellow and 4 red tubercles. Caterpillars crawl in groups, and finally form pupae in silk cocoons, wrapped in leaves, fastened by silk to twig, for 3 weeks or over winter.
FOOD HABITS	Food: of adults, nothing; of caterpillars, leaves of such trees as oak, elm, birch, and maple. The cocoons are made of a continuous silk thread that is exceptionally strong and might be used as a substitute for silk from the regular silkworm.	Food: of larva, the leaves of corn, cherry, elm, apple, oak, willow and other plants. The caterpillars have clusters of prickly spines that secrete a stinging poison that is most unpleasant when it touches the skin.	Food: mostly leaves of birch, willow, hickory, walnut, oak and other broadleaf trees. When young, the caterpillars remain together in groups. The plain green color provides excellent protection from many enemies, but there are many parasites.	Food: of adults, nothing; of caterpillars, the leaves of cherry, sassafras, lilac, sycamore, tulip tree, ash and others. In the cocoons, the females are a bit the heavier. Swinging cocoon difficult for birds to destroy.
ECONOMIC IMPORTANCE	Native silkworms always interesting to amateur collectors. Silk has commercial possibilities. Gut "leaders" may be had from caterpillars by killing them in saturated solution of salt and vinegar and drawing silk glands out through solution. Each caterpillar produces two silk glands. Such leaders from cecropia may be 6 to 9 feet long, able to sustain a 4 pound pull.	Not usually abundant enough to be of any economic importance. The caterpillars are sometimes sufficiently abundant to annoy berry pickers who come in contact with them.	Of little economic importance but always popular with amateur collectors, largely because of their great beauty. During the day, the moths usually hang beneath leaves with wings folded, rarely observed by passers-by.	Of little economic importance. Gut for fishing lines may be had from the caterpillars, but they are relatively short from this species.

CECROPIA MOTH *Samia cecropia*	APPLE TREE TENT-CATERPILLAR *Malacosoma americana*	TOMATO WORM SPHINX MOTH *Phlegethontius quinquemaculata*	BLACK SWALLOWTAIL *Papilio polyxenes*	TIGER SWALLOWTAIL *Papilio glaucus turnus*
Wingspread: to 6½ inches. Wings usually held vertically. Male: somewhat like female promethea, but with large, light crescent on inner half of each wing; abdomen, red, banded with black. Female: larger than the male, with more narrowly feathered antennae, and with larger abdomen. Nocturnal. Mating takes place usually between 1 and 4 a.m.	Wingspread: of male, 1¼ inches; of female, 2 inches. Rather stout, with body reddish-brown; and fore wings, with 2, nearly parallel, oblique, whitish lines. Male: darker brown than the female. Bodies may have a banded appearance or be plain, but are abundantly covered with hairy scales.	Wingspread: 4¼ inches. Males: ash-gray, and streaked, with 5 pairs of yellow spots on the body, conical; wings, narrow and pointed; tongue, long; antennae, thick and rough. Females: antennae; thinner and smoother, as in hawk moths or hummingbird moths.	Wing-span: to 4 inches. Wings: held erect when at rest. Male: fore wings, black, with double border of yellow spots; hind wings, black with double row of yellow spots, with single row of blue ones between, orange beneath, and with ½ inch wing "tails." Female: like male, but with yellow spots smaller, the blue spots larger, and without extra spot in cell of the hind wing.	Wing-span: to 5 inches. Male: with fore wing, yellow, with a black border, with black dashes across the wings, with yellow at the base, and with broad black and blue border; hind wings, with ½ inch tails. Female: larger than the male, with broader, black stripes, and without the easily-seen claspers seen on the end of the male's abdomen.
Common wherever food plants are available from the Atlantic Coast to the Rockies.	Found commonly on apple, cherry and similar trees in the eastern states and Canada and west to the Rockies, with some records from California. In the northern part of the range, the adults appear late in June.	Found about deep-tubed flowers particularly in summer evenings. This species is common from Patagonia to Canada. There are about 100 species of sphinx moths found in the United States.	Common in all of the United States and in southern Canada, with special varieties from Quebec, to Cuba to Colombia. Relatively common in gardens and fields where the food plants are being raised from May to September in the North.	Common in most of the United States and in southern Canada but not on the West Coast. Found in a great variety of places but favors open sunny areas generally.
Eggs: to 400, egg-shaped, pink-white, fastened in rows of 3 to 20 on leaves of many plants, with red-brown cement, hatch in about 15 days. Larva: black, then red; molts at 4, 5, 6, 8 days, spins cocoon 10 days later. Mature larva: blue-green, with large yellow, red, and blue tubercles, and with blue on the sides; about 4 inches long, matures in 4 to 9 weeks. Pupates in large, tough, spindle-shaped, white, then reddish cocoon, fastened to twigs.	In summer, or fall, female lays tapering ended cylindrical bands of varnished eggs on twigs. Eggs: about 1/25 inch long, 200 in a mass, hatch with opening of the leaves. Larvae begin feeding and making tent nest of silk. Larvae are about 2 inches long, black, with a *continuous* white stripe down the back, and blue and white on the sides. Larva about 6 weeks. Pupa: in 1-inch, silk cocoon, for about 3 weeks.	Eggs: large, green, spherical, shining, laid singly, on leaves of food plants, hatch after a short period, into larvae that are green, and become about 3 inches long, stout, with a row of 7, shaded, slanting stripes on each side, with an equal number of horizontal stripes making a V, and a good-sized, rear horn. Larva: to 4 weeks. Pupa: in ground, over winter.	Winters in pupal stage. Adults emerge in May, mate, and lay smooth, round, plain, yellow-brown eggs, singly, on under side of food leaves. These hatch in 5 to 10 days and develop into caterpillars that are green, ringed with black, spotted with yellow, smooth, and when mature, nearly 2 inches long, spined, and with a white saddle. Pupa: cradle-like, for 9 days, or over winter, erect on plants or boards, free swinging.	Winters in pupal stage. Adults emerge from May to September, mate and lay smooth, green, spherical eggs on the upper surfaces of the food leaves, laid singly and hatch in about 10 days. Larva: green, with 2 large eye spots at the front end, and a yellow stripe behind. Ugly looking, and vicious acting, because of 2 smooth "horns" and because of the eye spots. Two inches long.
Food: of adults, nothing; of larvae, leaves of box elder, apple, cherry, willow, plum and about 50 different kinds of trees, so the caterpillars can usually be reared easily with most tree leaves used as food.	Food: of larva, mostly apple and cherry but may also attack peach, pear, plum, oak, witch hazel, birch, barberry, willow and poplar. The tents provide shelter during larval stage. In rainy seasons, they do not do well. There are many parasitic enemies, and abundance varies through the years.	Food: of larva, leaves of tomato, potato, tobacco, and similar plants; of adults, the nectar in flowers. Possibly two generations a year. Pupa: like brown jugs, with long "handles" that contain the tongues, movable. Harmful to man personally, at no stages, the horns of the larvae not being poisonous as rumored.	Food: of larva, the leaves of carrots, parsnips, caraway and the like. The larva has an offensive odor and a perfect concealing pattern that provides good protection.	Food: of larva, the leaves of birch, poplar, ash and cherry. Pupal stage lasts from 2 weeks to over winter. It hangs erect, on twigs, usually away from the host plant, is wood-brown, cradle-like in a thread loop, 1¼ inches long, and straighter than in the black swallowtail.
Adults popular with amateur collectors and the larvae the producers of the longest and best of gut leaders of our native species.	Control by destroying nests, spraying leaves with arsenate of lead, burning caterpillars and cocoons, encouraging natural enemies. One school of thought contends that wild cherries should be preserved as a favored food tree; others contend that these should be destroyed. Egg collecting contests popular but of doubtful value.	Sometimes seriously destructive to the host plants. Best control is by hand picking or by use of lead arsenate spray, 2 pounds of paste, to 50 gallons of water. Adults assist in the pollination of some deep-tubed flowers.	Larvae may be injurious to some crops, but are easily controlled by hand picking, since they are rarely abundant. The adults are a pleasure to see. Caterpillars are harmless in spite of their rather startling appearance.	This species is of little if any economic importance but the adults are things of beauty admired by all who care for butterflies at any time.

COMMON NAME SCIENTIFIC NAME	CABBAGE BUTTERFLY *Pieris rapae*	ROADSIDE BUTTERFLY CLOUDED SULPHUR *Eurymus philodice*	GREAT SPANGLED FRITILLARY *Argynnis cybele*	MEADOW OR MARSH FRITILLARY *Brenthis bellona*
DESCRIPTION	Wing-span: to 2 inches. Male: with fore wing, white above, yellowish beneath, black-tipped, with one black spot that is sometimes absent in the spring; hind wing, white above, and yellowish beneath. Female: fore wing like that of male, but with 2 black spots that may be smaller in the spring; hind wing, like that of male. Wings folded or open when at rest.	Wing-span to 2½ inches. Male: with fore wings, yellow above, and with a narrow black border. Females: with wings broader, sometimes by an inch, and usually containing yellow spots. There are two kinds of females, one being yellow and the other being almost white. Also known as clouded sulphur butterfly.	Wing-span: to 4 inches. Male: fore wing, cinnamon, with numerous, black markings, with round silver spots beneath: hind wing, with broad yellow stripe, and brown hair-fringe above. Female: like male, except that half of the wings next the body on the upper side is dark, while in the male it is only slightly so.	Wing-span: to 1.8 inches. Female: larger than the male and darker. Cinnamon brown, with numerous black markings. No silver markings beneath, such as are to be found on the great spangled fritillary, and on the small silver-bordered fritillary, *B. myrina.*
RANGE	Very common and cosmopolitan but limited essentially to temperate zone. Found mostly about gardens, flowerbeds, and in fields where its food crops are being grown. Three groups of family are recognized: the whites, the yellows and the orange-tips, of which there are a dozen whites in North America.	Common, along roadsides, in flocks, about muddy spots, often closely crowded together. Cosmopolitan, from St. Lawrence River, south to South Carolina, and west to Rocky Mountains. Closely-related orange sulphur butterfly, *E. eurytheme,* is found west to Pacific, in Southwest, and east to Maine.	Common about fields in late summer particularly where weeds are likely to be tall. Name fritillary refers to dice-like spots on wings. Two commonest species are great spangled, and variegated fritillaries. Former ranges through eastern United States west to Great Plains.	Common, in wet fields, in the fall, ranging throughout Canada and the northern states, west to the Rocky Mountains, and south into the Carolinas. There are 16 species in the genus in North America, two of which are arctic and limited to higher mountains. *B. montinus* of White Mountains, N. H., is one of these.
REPRODUCTION	Winters as pupa or sometimes as adult. In North, 3 generations a year. Eggs: yellow, flask-shaped, with 12 vertical ribs, laid singly, on under surfaces of food leaves, hatch in 1 week. Larva: green, with fine hairs and with yellowish backband, 4/5 inch long, maturing in 2 to 3 weeks then forming the pupa that lasts from 10 days to over winter. Pupa: green, slender, 4/5 inch long, angular.	Eggs: pale yellow, changing to crimson, slender, laid singly on clover and other legumes, hatch in 4 to 5 days, and develop slender, green caterpillars, without longitudinal stripes, over an inch long, with heads lighter than the body, covered with fine hairs. Winters: in various stages. Pupates: for as short as 10 days. Pupa: pale green, straight, pointed, not angular, ¾ inch long, with narrow, yellow stripe.	Eggs: short, cone-like, higher than broad, ribbed, honey yellow, laid singly, or dropped in flight, hatch in about 15 days. Larva: at first, rough, warty, greenish brown; winters as young caterpillar, then matures following spring, becoming black, 1 1/3 inches long, with spines in belts, branching. Pupa: hangs for 14 to 24 days.	Generations a year: 1 to 3. Eggs: tall, dull olive, prominently ribbed, laid singly, on food plant, hatch in 5 to 9 days. Larva: olive-brown, with green markings, apparently spiny with spines in a belt arrangement, nearly 1 inch long; winters as half-grown caterpillar. Pupa: about 1 week.
FOOD HABITS	Food: primarily cabbage, and closely-related plants in mustard family. In South, may have 6 generations a year, and appear in great numbers. Caterpillars eat through leaves, into heads of cabbage and generally make trouble to gardener. Introduced into America in 1866. Makes chickens that eat it sick.	Food: the larvae feed on clovers and other legumes. The orange sulphur butterfly or alfalfa caterpillar is frequently a pest in alfalfa, particularly in the West.	Food: larvae eat the leaves of violets at night, spending the day in hiding. The adults eat nectar from flowers. Pupa: about 1 inch long, roughened, brown, coarsely wrinkled, and inconspicuous. Eggs may be laid on food plants or elsewhere.	Food: leaves of violet, eaten at night. The adult feeds on nectar and, in the East, seems to favor asters. Pupa: bluish-gray, with dark spots and with 2 rows of small cones on the back. Adults: gay little butterflies, are common near the centers of human population.
ECONOMIC IMPORTANCE	Control is commonly by hand picking and by spraying the leaves with Paris green using 1 pound to 50 gallons of water. Sometimes soap is added to make the spray stick to the smooth leaves of the cabbage. Plants so treated of course should be washed thoroughly before being used as food.	Not usually enough of a pest to need control. The adults are always interesting, and, to some, they provide suggestions for compass direction. This hardly seems dependable and may be in the class with the ability of daddy-long-legs to locate the cows.	Since the food of the larvae is wild violets that are not considered to be of economic importance these butterflies are not classed as pests. They are always beautiful to watch as adults.	Of little or no economic importance apparently since the food plants are mostly wild violets that have little economic importance.

MOURNING-CLOAK BUTTERFLY *Aglais antiopa*	RED-SPOTTED PURPLE BUTTERFLY *Basilarchia astyanax*	WHITE ADMIRAL BANDED PURPLE *Basilarchia arthemis*	VICEROY BUTTERFLY *Basilarchia archippus*	MONARCH BUTTERFLY MILKWEED BUTTERFLY *Anosia plexippus*
Wing-span: to 3½ inches. Male: fore wing, maroon, with broad, straw-yellow border, blue spots on upper surface, and almost black beneath; hind wing: like fore wing and with suggested "tails." Female: similar to male. There is a rare variety in which the straw-colored border reaches mid wing.	Wing-span: to 3¼ inches. Male: fore wing, black, with border of blue dashes, and rusty spots beneath; hind wing, like fore wing except that the outer half is washed with green or blue. Both sexes show red spots on the under sides of the wings, the general color there being brown.	Wing-span: to 2¾ inches. Highly variable. Wings: in general, dark, with a broad, white band crossing them from front to rear. This band may become narrow or even lacking in some individuals. Hind wing: may bear red and blue, oblong or crescent spots against a black background, towards the outer edge.	Wing-span: to 3½ inches. Male: fore wing, orange brown, with white-spotted, black border, and conspicuously black veins; hind wings, like fore wings, but with extra, black, cross band about as wide as veins. Female: like male, but larger. Viceroy resembles monarch except that it is smaller, has extra band on hind wings and lacks male's scent gland.	Wing-span: to 5 inches. Upper surfaces of wings: light, reddish brown, with black veins and borders, and with two rows of white spots on the outer borders. At rest, the wings are held above the back with the hind wings covering most of the fore wings. In the male, one vein in each hind wing is swollen as shown. It is a scent gland.
Common through year, being seen often in winter and not infrequently coming into houses. Most common near woodlands from June to August, ranging from southeastern Canada through middle states, where there are 2 broods a year. May be found between Arctic Circle and 30° N. Lat.	Common all over the United States and Canada west to the Rockies but more uncommon in the Gulf States area and commonest in June to August. It occurs in the highlands of Mexico. The close relatives include the banded purple, the white admiral, and the viceroy.	Common from Ontario and Quebec through New England to Pennsylvania, and in the higher mountains further south; not recorded in the West, but is replaced there by a similarly marked *B. weidemeyeri*, which is found east to western Nebraska. Closely-related to red-spotted purple.	Common, particularly in open fields during August and September, from Canada to the Gulf. It is a close relative of the red-spotted purple and the white admiral butterflies.	Common in most of the United States, in fields and along roadsides, sometimes migrating in great flocks that may settle on a single tree weighting it down. The family includes subfamilies of most of our more attractive butterflies. This species is in the subfamily Danaidae.
Eggs: dark brown, or black, barrel-shaped, laid in rings around twigs, hatch in 9 to 16 days. Larva: head, angled; with head and body, black; body, spined and white-spotted, with red on the middle of the back; prolegs, reddish; 2 inches long; group of larvae stays together. Pupa: on twigs, 8 to 16 days, dark brown, with red-tipped swellings, often with whitish bloom, over 1 inch long.	Eggs: globular, yellow green, to dark brown, many, laid singly, on the leaves of food plants, hatch in 7 to 9 days. Larva: body, naked, humped, irregular, streaked, with a pair of rough, black, clubbed horns, with many, minute, wart-like structures over back, resembles bird dropping; 1½ inches long; winters as small caterpillar, hung on tree, 10 to 12 days.	Eggs: grayish green, with "kite-shaped" cells, laid on the food plants. Larva: greenish, to olive brown, blotched with white when mature, the white sometimes appearing as a saddle, coarsely humped, and with two prominent, but short horns near the forward end. Pupa: hangs in a tree a few days.	Eggs: deep green, globular, pitted, laid singly, on the upper or under leaf surfaces of the food plants, hatch in 4 to 8 days. Larva: resembles bird dropping, irregular, warty, with a pair of long, clubbed, prickled tubercles near the front, black, over 1 inch long, may winter as a caterpillar. Pupa: hung on a tree, for from 7 to 10 days.	Eggs: green cones, with lines of pits laid singly on milkweed leaves, hatch in 4 days or less. Larva: green with black and yellow cross marks, and a pair of slender movable "horns" at each end. Molts: 4 in about 10 days. Pupa: pale green, spotted with black and gold, free-hanging by a thread, about 12 days.
Food: of larvae, leaves of elm, poplar, willow, hackberry and similar trees; of adults, nectar. The mourning cloak is one of the tortoise-shell butterflies in which the adults hibernate, and are restricted to the north temperate zones, except for the colder mountains of the sub-tropics.	Food: of larva, leaves of plum, apple, pear and gooseberry, but rarely, if ever, sufficiently abundant to be considered as a pest. Pupa: queerly colored, yellow, brown, olive and salmon, is glossy, and nearly an inch long.	Food: of adult, nectar; of larva, the leaves of willows, apple, plum and thornapple. This butterfly undoubtedly comes from the same stock that the red-spotted purple does, and in territory where this northern species meets that southern species individuals may be found having the characters of each.	Food: of larva, the leaves of willows, poplars and aspens; of the adult, nectar. The pupa resembles that of the red-spotted purple, being queerly colored yellow, brown, olive and salmon, glossy and hung on a tree.	Food: of larvae, the leaves of milkweed. The larvae and adults are reputed to be distasteful to birds. Big fall migrations to the South are obvious. Northern migration may be merely the moving of individuals into new territory. May be 3 weeks from egg to adult.
Sometimes considered pests but only rarely so. May be controlled where abundant by picking off the egg masses on twigs of the food plants.	Control not necessary because of relatively small numbers at any one time. Adults: so attractive that they are prized by amateur collectors.	Of little economic importance but of considerable importance to naturalists who are interested in interrelationships of species and the relation between range and the persistence of given characters.	Of little or no economic importance. Interesting because of mimicry of the monarch butterfly that is reputed to be avoided by its enemies because of unpleasant scent that is lacking in the viceroy. The viceroy apparently enjoys the immunity found in the monarch.	Since the food plant is the milkweed that is not normally considered of economic importance this butterfly can hardly be considered as harmful to man's interests. Its migration habits are not completely understood but its beauty as a pupa and adult are thoroughly appreciated.

BAGWORM AND (RIGHT) THE APPLE TREE TENT CATERPILLAR.

LARVAL, PUPAL AND ADULT STAGES OF THE GREAT SPANGLED FRITILLARY.

lifetime. Frequently these "jugs" of tomato worms are dug up, and, since they retain some ability to move, they often startle their finders by suddenly moving without warning.

Probably one of the most startling methods of getting protection during the pupal period is employed by the promethea moths. These seek, of all places, the exposed end of a fine twig. There, in view of everything that might be considered an enemy, they calmly wrap themselves in a leaf effectively reenforced by silk and firmly bound at one end to the twig. When winter comes they still swing gaily in the breeze where anyone can see them.

The Adult. For the most part, adult moths and butterflies are masterpieces of Nature in point of beauty. Even the nondescript "millers" are beautiful in themselves, or match the environment where they rest in intricate detail.

Of course the prime function of the adult is to meet a member of the opposite sex, mate and produce fertile eggs. There have been those who claim that the beauty of the insects is associated with success in this usually highly-competitive field. Unfortunately for this notion, Frank Lutz and others have shown us that what we see in these insects is not seen by others of their kind, and the part of the spectrum that discloses one pattern to us is useless to insects. There is as good, or better, evidence to indicate that scent is the factor that brings two loving lepidoptera together.

With some moths and butterflies, there are conspicuous sex differences. Frequently, at least in the large silk moths, the antennae of the males are larger than those of the females. The color pattern, or the relative size of scent glands, or the size of the abdomen, or other variations may be used to distinguish the sexes of some species. One intriguing difference is found in the promethea moth where the two sexes look radically different and behave differently. The female is a night-flier, like most of its relatives, but the males fly by night or day, as anyone may have discovered who kept some female prometheas captive in a screened box or window.

There is no month in the year when some adult moth or butterfly may not be found active outdoors, even in the northern states. A dark mourning cloak butterfly fluttering about a snow-covered woods in the dead of winter is a sight to be remembered.

We have said—and can say—nothing here about the destructive qualities of many moths and butterflies. Army worms, gypsy moths, brown-tail moths, clothes moths, tent caterpillars, cutworms, codlin moths are only a few of the hosts of these creatures whose food or other tastes are similar to ours, and which, because of this, compete with us for certain plants for which we have a use. Often, the fight is a knock-down, drag-out affair. Neither have we said anything of the hosts of parasites that attack moths and butterflies at almost any stage of their existence, or of the birds and mammals that feed on them to our benefit. Last, but not least, we have said little about the appeal of the lepidoptera to the naturalist who loves them for their beauty. One of the problems in writing these inserts is that it is hard to stop. With that, we will end the problem in this case, and tackle some others equally disturbing.

CECROPIA MOTH (LEFT) AND THE MEADOW OR MARSH FRITILLARY

Stand By to Repel Raiders

MAKE NO mistake about it, we are facing a period of raid upon our public lands. It is a well although quietly organized program, and finds form in legislation to present Federal land, under one pretext or another, to the States. The threat is not alone to unreserved public lands, but to publicly-owned grazing lands, to parts of National Forest areas, in particular those parts not supporting timber and used for grazing, and, even, areas under the jurisdiction of the National Park Service.

Private and special interests are behind this drive —stockmen, lumbermen and some mining interests among them. Many chambers of commerce have been sold a bill of goods, and are tub-thumping with the drumsticks of local pride. Such organizations have never been noted for having the broad viewpoint of national interest, and they throw around a lot of weight in the offices of members of the Congress.

Besides specific legislation that has been introduced in Congress to effect such transfers of land, there are items of insidious propaganda to ease the way of such measures. Typical are rumors started by lumber interests in the Northwest that the National Park Service has adopted a new policy with respect to lumbering on National Park and Monument areas, letting down the barrier. These have brought denials from the Secretary of the Interior, but the seed is sown.

Another example of what is going on is found in the *California Mining Journal*, which captions a picture of Joshua trees in Joshua Tree National Monument as follows: "The Joshua trees of San Bernadino and Riverside counties — eight hundred thousand acres of them—block the mining industry in that area! This vast acreage has been withdrawn from public entry to protect a few scrubby trees that are of absolutely no value, sentimental or otherwise." There is a mineral area in the eastern part of the Monument, and that area is of little scenic value. Indeed, the Park Service is redrawing boundaries to exclude this area, but the whole Monument is threatened, nevertheless.

The drive of the grazing interests against Federal lands, whether under Forest Service or Grazing Service jurisdiction, is particularly vicious and dangerous. Let a forest supervisor try to control grazing on National Forest lands within proper limits and his head may be lopped off. Such conscientious public servants will suddenly find themselves "transferred", so powerful are local special interests.

The interests promoting this drive against our Federal land administrations, which are such a vital part of our whole national conservation program, are smart. They recognize that there is a rather widespread and quite well-nurtured irritation with government controls, whether they be concerned with beef cattle, butter or beaverboard. Thus it is easy to build up a superficial and uninformed local and regional sentiment to which election-bound Senators and Representatives are more than usually responsive.

But what are the dangers lurking in such a drive? The fundamental danger, of course, is to the soil, than which there is nothing more fundamental. Turn the administration of grazing lands, for example, over to the states in which the lands lie and you will be turning them over to the grazing interests. No States have any organization in the least equipped to administer such lands; no adequate laws to control the manner in which they are used; no scientific know-how to create either administration or laws. Furthermore, any administrative organization that might be cobbled together by state authorities would be controlled by the cattle and sheep interests.

Such a course, so far as grazing is concerned, is to invite a national catastrophe. It would open the doors wide to erosive ruination of the soil; would invite myriad small dust bowls to merge into larger and larger ones. Generally speaking, the range has been vastly improved everywhere since the passage of the Taylor Grazing Act and the application of common sense and scientific knowledge to the use of the range. And the very impersonality of the Federal regulations has been the secret of this success and the guarantee of the future. The grazing permits issued under the Taylor Grazing Act are issued under the supervision of a grazing board for each district. These boards are composed of duly elected representatives of the permittees themselves, thus avoiding bureaucracy and providing local autonomy under Federal law.

There appears to be some division of opinion among the mining interests as to the wisdom of such proposed transfers of land. The smaller operators in many cases recognize that the Federal regulations are really a protection against the better-heeled big boys. Some lumbermen, of course, have long viewed the National Park forests with jealousy and frustration, and with mighty little consideration for the country as a whole. They would love to get a toe in the door and be allowed to cut off a few acres of National Park timber, just to show that it can be done and to establish a precedent for doing it more.

We simply cannot afford, as a nation, to play fast and loose with any of these resources of land, whether they be set aside for esthetic reasons, to support a national reserve of timber, or protect the grasslands from over-exploitation. We must not yield to specious claims that we should let down barriers to aid the veteran—a currently-popular plea; to get back to State control and get rid of bureaucrats; to give local chambers of commerce new feathers for their caps. The issue is vital. It concerns the future of our country, and that future must not be bartered for the benefit of any selfish privilege or myopic interest.

The Wolverine

By GORDON T. WOODS

Illustrated by Walter A. Weber

One of the strangest and most interesting forms of living, flesh-eating animals is the wolverine, which is now headed down the fading trail toward extinction. Primarily responsible for this alarming decline has been the intensive and unregulated trapping of wolverines, which still persists in some of the more important fur-producing regions. Civilization's heavy heel has reduced the animal's numbers faster than it can reproduce itself.

Today, there may be less than seventy-five wolverines in the United States, all of them making a last stand in small, isolated groups in national forests and national parks of the West. The growing scarcity of the animal in Canada and Alaska is also alarming. Fur buyers, trappers, naturalists, and wildlife workers are aware of the precarious status of the species, but intelligent management measures are still lacking. Unless the wolverine is afforded immediate protection from the destructive resourcefulness of the human race, it may not answer the roll call of our interesting species at the end of the present century.

Wolverines were probably never abundant, although widely distributed over sub-Arctic regions. It is a boreal animal in both hemispheres, but most abundant in northern North America, where it ranges from the Arctic tundras down to and beyond the timber line. Some of the records previous to the middle of the nineteenth century show that it ranged north of latitudes 42° and 43°. One was reported from the Berkshires in Massachusetts, and Audubon secured specimens in Rensselaer and Jefferson Counties in New York. In more recent years it has been found to occur as far south as Walker Pass below Mount Whitney. Although Michigan is known as the Wolverine State, strangely enough there is no authentic record of a wild wolverine ever having been seen within its borders.

There are few persons, in fact, who have ever seen wolverines in their natural state, even in localities where the animals are known to be relatively common. In size and form the wolverine is something like a badger, measuring about three feet in length, sturdily built, covered with coarse dark-brown fur with a broad, light, lateral band, and supported by rather short, stout legs, the toes of which terminate in strong, sharp claws, considerably curved. Its feet are semi-plantigrade, and in walking the back is arched high, while both head and tail are carried low. Remarkably small eyes set in a massive skull, and the rounded ears, as well as the somewhat elongate form, characterize the wolverine as one of the Mustelidae.

As in other mustelids, the wolverine is provided with anal glands, which secrete a yellowish-brown fluid possessing a highly fetid odor. The function of

The wolverine will follow other American animals down the road to extinction unless steps are taken to learn more about its needs and habits and to provide places where it may live in safety.

this gland is not definitely known, but probably is used in establishing scent posts for attracting a mate.

The shape of the wolverine and some of its habits have earned for it a variety of scientific and popular names, more than twenty of which are mentioned by Coues in his *Monograph of North American Mustelidae.* Scientists refer to this animal as *Gulo luscus*—*Gulo* being the generic derivation from the Latin *glutio,* meaning glutton or gormandizer, and *luscus,* meaning blind or half-blind. This nomenclature has been interpreted by Coues and other writers as indicating that Linnaeus, who first described the animal from Hudson Bay, had a specimen that had lost an eye. They seem to forget that the wolverine has notably poor sight, a fact that Linnaeus may have considered. At least seven species of American wolverines have been described, but Dr. H. E. Anthony, Curator of Mammals at the American Museum of Natural History, believes ". . . that all of the North American Wolverines should be subspecies of one full species, *luscus.*"

Among the common names applied to this superweasel are Wolverine, Indian Devil, Skunk Bear, Glutton, and the French-Canadian term, Carcajou. No one seems to know how Wolverine originated, but it seems to be absolutely meaningless. Ernest Thompson Seton, in his *Lives of Game Animals,* attributes the name Skunk Bear to the fact that the wolverine reminds one of a large skunk, the broad, yellowish, dorsal stripe of which has slipped down over its back. The sturdily-built body and legs also suggest a small bear. The name Glutton, however, as given by *The Encyclopedia Britannica,* and widely used by early European writers, is hardly distinctive, since wolverines are no more greedy than other carnivores, which are all heavy eaters when food is abundant.

The propensity of the wolverine to interfere with the trap-lines has earned the enmity of the trapper. A single animal has been known to follow a line of marten traps extending forty to fifty miles, approaching each trap from the rear of the blind, extracting the bait, then pulling up the traps, and devouring or concealing the entrapped martens. So persistent is the wolverine in this respect, when once it discovers a line of traps, that trappers have always sought to extirpate it on their trap-lines as a necessary preliminary to success. The restricted distribution and low numbers of the present wolverine population mutely testify in part to the success of this persecution.

Probably the scarcity of wolverines has not changed the biological traits peculiar to the species, but plainly it has increased the difficulty of learning its true status in the restricted regions now occupied. In order to help it to survive we need to know more about its food requirements; its breeding habits; its territorial requirements, that is, the area within which an adult pair of wolverines may live and reproduce. We need also to know what influence this wolverine family will exert upon the local fauna, for it is plain that any measure of protection must involve its existence among other wildlife forms with which it must share its environment.

In spite of the lack of definite facts at man's disposal, the stories of the wolverine are legion and fanciful. Suffice it to say that most of our present knowledge of *Gulo* is confined to the tales of hunters and travelers, unchecked by proper investigation. Yet, as Dr. Coues adds: "Coming down to us through such a long line of illustrious godfathers, they were treated with the respect generally accorded to long years, and furnished the staple of professedly educational textbooks."

This lack of information on the life history of the wolverine also prompted Seton to write: "Here, we know, is a personality of unmeasured force, but so enveloped in mists of legend, superstition, idolatry, fear, and hatred, that one scarcely knows how to begin or what to accept as fact."

It is thought that wolverines mate during the month of March, the female bearing two or three—but sometimes five—young in June or early July in a nest of leaves under a ledge of rock or low-hanging

tree branch. As in some of the best human families, the job of raising the youngsters is left to the mother. In the fall the young may still be seen following their mother, and by the following spring are full-grown and ready to shift for themselves.

In the stomachs of wolverines have been found grasshoppers, frogs and berries. More frequent items on their bill of fare are such animals as squirrels, grouse, foxes, hares and beaver, and carrion from the bodies of several game species that have fallen victims to accidents, diseases, the larger carnivores, or man.

As for the voracious, insatiable appetite so often attributed to wolverines throughout the literature, I should add my own daily observations over a two-year period of a large, fourteen-year-old, male Alaskan wolverine in the small museum zoo at the University of Michigan. During the winter the animal received daily a pound of meat scraps (in the late spring and summer only three-quarters of a pound), with once in a while an egg. In terms of energy units this thirty-eight-pound captive wolverine consumed on the average about 1200 calories per day in winter and about 900 calories per day in summer, approximately the amount needed to maintain life and growth of an average two-year-old child. Obviously, these observations lack the vividness of the gastronomic exploits cited in many early accounts.

The fur of the wolverine is coarse in texture but extremely durable; it will outwear most other commercial furs. The Eskimos and northern Indians value the fur highly for lining their parkas, particularly about the face, because the fur, unlike most other furs, does not collect frost or hold moisture from the breath. Although not extensively used, other uses made of wolverine fur include trimming material, and it is said that a number of skins sewn together make a beautiful hearth-rug. Wolverine fur is prime at all seasons, but the value of the pelt may vary seasonally. The average price paid for a wolverine pelt is about five dollars, but may run as high as fifteen. Indicative of the decrease in their numbers in Canada is the number of wolverine pelts received by the Hudson's Bay Company, which during the last fifteen years has been downward from 1500 to a low of 450, averaging between six and seven hundred. Many of the skins collected by the traders, however, never leave the country, but are re-traded to the Eskimos, who prize them highly for the reason mentioned.

It is no easy task to trap wolverines, for usually they are too cunning to be caught by the usual methods employed in catching other mustelids. However, Joseph S. Dixon, field naturalist for the U. S. Fish and Wildlife Service, whose field experience has extended from Point Barrow in Alaska to the Mount Whitney region in California, believes that the reputed cunning of the wolverine has been very much over-estimated. He says:

"It has been the experience of a trapper friend of mine here in the Sierra Nevada who has trapped quite a few wolverines, that they are not particularly wise because they walk into traps which no self-respecting coyote would think of being caught in. Furthermore, in a known instance, a wolverine which was caught in a trap escaped by pulling off one of his toes, soon returned and was caught again in the same trap, which does not indicate a very high degree of intelligence."

Occasionally, a few wolverines are taken alive and shipped to some distant zoological park, where they are exhibited to persons who otherwise might never see one of these rare animals. Unfortunately, captive wolverines have been unable to propagate successfully. In the Detroit Zoological Park, where several wolverines are confined to the same enclosure, there have been one or two instances in which a young one was born, but was either killed by the mother or consumed by the other wolverines. Their span of life in captivity may reach fifteen years, but recent correspondence with the larger zoological parks throughout the United States and Canada indicates that the average length of life is restricted to about six years.

Research studies are needed to obtain accurate information on more of the wolverine's life habits, and with specimens of such rare animals still available, it seems strange that the extensive scientific research programs of the U. S. Fish and Wildlife Service, some of the larger zoological parks, and many of our well-known educational institutions have not obtained more pertinent facts.

Because some individual wolverines will live up to their alleged atrocious reputation, it seems likely that trappers operating in most regions where these animals still occur will continue to eliminate the species for this reason rather than for the value of its pelt. Already this mammal, the largest member of the weasel family and sole representative of the genus, is threatened with extinction, to follow that notable list of native American (Continued on page 444)

Organization

By NORMAN EDSON

What if the birds and bees and butterflies
Should tire of playing servant to the flowers,
And strike for higher pay with shorter hours,—
Demanding that all blossoms recognize
Their constitutional right to organize,
Or else, from hiring halls in leafy bowers,
Their officers endowed with certain powers,
Would picket all the plants that pollinize?

How quick the buds and blossoms would agree.
They'd never even stop to arbitrate,
And, knowing just how useless it would be
Without the birds and bees to propagate,
They would at once with sweeter nectar pay
Each willing worker for a shorter day.

They Grow Large on Okinawa

By RALPH J. DONAHUE

Photographs by Walter E. Salmon

EARLY in June I saw my first giant Okinawan silk spider. It was on the center of a big, six-foot web within a hundred yards of the spot at which I trudged ashore. Despite the urgency of the moment, I gave the big, black, yellow and white spider more than a passing glance. Although the sound of gunfire was heavy in my ears, and deep, yellow mud clung to my boots at every step, I decided the island might have interesting possibilities.

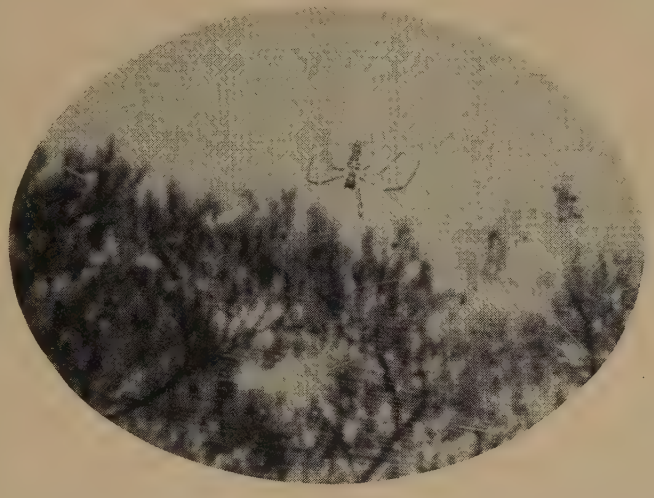
Insects were plentiful on Okinawa, and often of huge size, but they failed to interest the invading troops as much as the giant spiders and centipedes, which were somewhat less common. Spiders and myriapods, the world over, are held more or less in dread, and we seem to remember them long after the memory of the flight of a brilliant beetle, or the passing of an exotic butterfly, has been erased. The Ryukyus "many-leggers" were no exception, and conversation having to do with enemy action usually included comments on snakes, spiders and centipedes!

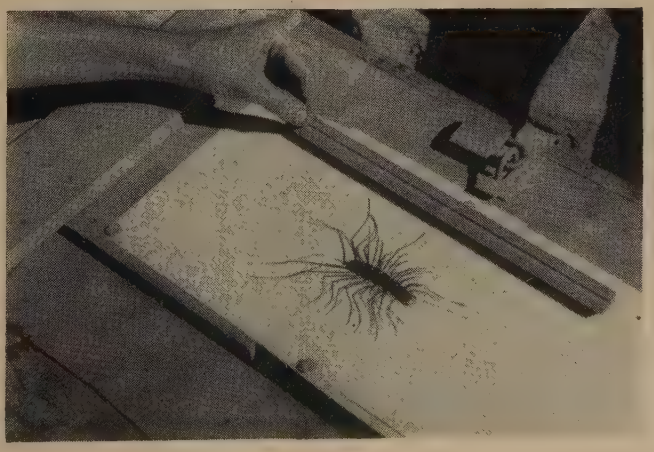
After the island was "secured", and the Japs dug from myriad hillside caves, I frequently received permission to go on collecting trips. But, after the troops learned I was interested in "bugs", both officers and men brought me valuable specimens, or told me where they could be found.

Of the many species of web weavers on Okinawa, the *Nephila* silk makers were by far the most conspicious, if not the most common. Their huge snares were to be encountered across many a woodland trail, blocking the entrances to caves, or spun between trees high above the heads of native passers-by. I found one such web suspended from a supporting line thirty feet from the ground, and stretched from a pine tree to a giant banyan, fully fifteen feet away. The area of the main web was in excess of five feet!

The females of the commoner species of *Nephila* were sometimes found to be a velvety black, but others were more brightly decorated with stripes of green-gold, lemon-yellow, white and cream. Several of the larger ones brought to me measured six inches from the tips of their front feet to the tips of the hind ones. They had abdomens as large as a man's thumb, and were striped like a Kentucky watermelon.

After the completion of the web, Madam Nephila usually stood guard at its center, with her head towards the ground. From this position, with her many eyes, she watched at leisure the whole concourse of insects. During July her mate was usually found somewhere on the outer perimeter of the web, a non-spinning and comparatively insignificant creature of black and yellow or rusty brown. Usually there was but a single male on the one web, but one day I found a large and hefty female that had three seekers after her favor. I never knew the outcome of this "quadrangle" for, three days later, when I came to check up on the swains, I found the web destroyed and the spiders missing.





Giant silk spider of Okinawa at her web, twelve feet above ground and between two pines. Below, Okinawan version of the house centipede, a myriapod that ranks among the largest of its kind.

Many orb-weaving spiders make a new net daily. Not so with *Nephila*. The broken strands of one day's snaring often were repaired by the following morning, or the day following that. But, it seemed, the weaver lost some of her pride in the repair work, for the added strands never properly joined up with those of the original spinning.

Judging by my observations, Madam Nephila does not wish her fine net-

(Continued on page 444)

Field naturalists, collectors, and students of animal habits win success by—

"Squeaking" Animals

By J. ALDEN LORING

Illustrated by Olaus J. Murie

★

". . . a red fox . . . turned abruptly when squeaked and came quite close before he discovered his mistake."

MANY BIRDS and mammals may be lured from their retreats to points where they can be easily observed by a certain method of calling, which for our present purposes we term "squeaking."

Many warm-blooded animals, both birds and mammals, quickly respond to a well-executed squeak, reacting either from curiosity or because they interpret it as a danger signal that warrants investigating. It is accepted by many flesh-eating animals as an invitation to a meal.

To squeak, you merely place your moistened lips against the back of your hand, or against a single finger, then draw or suck in your breath. You can regulate the pressure so as to produce a series of high-pitched squeaks, in an endeavor to lead your subject to believe that some new source of food, or some threat of danger, has just turned up.

Often you will get a genuine thrill by enticing some of the extremely shy birds that ordinarily you are unable to approach. Sometimes they will come within a few feet, where under favorable circumstances you may be able to study them minutely.

Although naturalists have used this method for many years, it is likely that nine out of ten of your acquaintances will be surprised when you first try it on them. If they have no warning, and ask you what is making that peculiar noise, it is a great compliment to your art. Friends of wide experience tell me they have used this method to attract within close range a large proportion of North American land birds, and many rodents and carnivores.

With a little practice you can gain a repertoire of astonishing variety, ranging from a high-pitched squeak, so faint that the sharpest human ear can barely detect it, to a shrill squeal that may carry for several hundred yards. These may be modified by clucks or chippers made by the lips and tongue alone; without recourse to the sucking method.

Many native American tribes attract their prey by

The marten on Cumbress Mountain in New Mexico came quickly in response to a squeak.

"Whatever your method, your degree of success will be increased if you wear neutral colors that blend easily with your surroundings."

squeaking, usually using only the lips, but an expert in the sucking technique can often beat the Indians at their own game, chiefly because the unaided lips soon tire, while those using the sucking method can keep on almost indefinitely. An occasional bird caller may attain phenomenal proficiency by variations in whistling; such a performer is Bert Harwell. Also a few species of birds can be successfully imitated and lured by the human voice, especially when one is young and can imitate the scream and other calls of such birds as the bluejay or red-shouldered hawk. Such calls, of course, require much practice.

Whatever your method, your degree of success will be increased if you wear neutral colors that blend easily with your surroundings. Perhaps the most important factor is your ability to avoid any sudden movement. For this reason one will do his best when alone. But a small party, well trained, may share the thrills that accompany the enticing of the rare warbler, or the tiny, retiring rodent or carnivore that is likely to appear at any moment.

". . . she flops over the ground with wings half-spread as if suffering serious injury."

If you wish to get the maximum results from your observations of the spring migrants, practice squeaking at once so that you will be ready for them when they arrive. Sparrows, wrens, vireos, warblers, and many other perching birds respond quickly to squeaks. This is especially true during the breeding season, when the parents are concerned about their eggs or young. However, satisfactory results can be obtained at any time throughout the year.

If your object is identification only, stop squeaking as soon as the subject reacts, and remain silent until its curiosity is satisfied. If it is not then within sufficient range, give a few more squeaks until satisfactory results are obtained. By remaining motionless, and with patience, an animal may perch on your head or shoulder, but, with the exception of chickadees or chipmunks, this rarely happens. Above all, avoid any sudden movements.

Should you be fortunate enough to meet with a ruffed grouse with a brood of young chicks that have already taken refuge under leaves, or other forest logs and debris, you have a chance to witness a remarkable demonstration of mother love and bravery that will give you the surprise of your Nature-loving life.

While the chicks are scurrying to shelter, mother becomes seriously affected; squealing piteously, she flops over on the ground with wings half-spread as if suffering serious injury, but, when followed, manages to keep just beyond your reach. Follow her a few steps and then suddenly drop to the ground and snatch at an imaginary object, and as you rise give several squeaks, wringing your hands in front of you but, at the same time, being ready to protect yourself. Almost invariably she will fly right into your face.

"Eight or ten times I have squeaked minks that were running along the shore. Almost without exception they plunged into the water and swam out to my canoe."

After this outburst, and when she has subsided somewhat, give her the satisfaction of thinking that she is deceiving you by following her up and see how far she will decoy you before taking wing.

Hawks and owls, while hunting, may chance to pass within hearing of your squeaks. They will often change their course of flight until they have discovered you, and even then may perch nearby, reluctant to believe that they have been cheated out of a meal.

"Weasels . . . are the most satisfactory animals to squeak."

Chipmunks (particularly our western species, which are far more active and inquisitive than the eastern type), as well as the many different species of ground squirrels, and the chickarees or red squirrels, are easily attracted. They are full of curiosity.

While seated at the foot of a large tree in a forest on the bank of Athabaska River, I had been watching three or four chickarees that were chasing each other about. A squeak put an abrupt end to their antics, and they started to investigate. In no uncertain language they told me exactly what they thought of me, but, as I did not move, they became bolder and bolder until one ran up the trunk of my tree and finally jumped to my shoulder. For several seconds it prowled about my body, then dashed into the timber, turning at intervals to hurl insults at me.

At another time, while I was resting at the edge of the forest, a red fox, passing within a hundred yards of me, turned abruptly when squeaked and came quite close before he discovered his mistake.

But you will probably get your greatest thrills from the various species of the weasel family, especially the weasel, mink, marten, otter and fisher.

I had paddled up to the dock on an Adirondack lake, and was talking to friends, when a mink crossed the shore end of the landing. I squeaked him and he wheeled about and ran out to within ten feet of us, watching us for fully a minute. Several times he started away, but I squeaked him back, until finally he became discouraged and left for good.

Eight or ten times I have squeaked minks that were running along the shore. Almost without exception they plunged into the water and swam out to my canoe, lingering near as long as I kept squeaking at intervals, reluctant to believe that I was a Nature faker.

High up on Cumbress Mountain in New Mexico, in a mass of rock that for ages had been crumbling from the cliffs above, I caught a glimpse of a marten as it ducked into a crevice. A squeak brought it out at once, and now its skin is in the former U. S. Biological Survey's collection of mammals, in the National Museum at Washington, one of the few ever found in the State.

Weasels, because of their boldness, and the perseverance with which they "stick around," even following one about, are among the most satisfactory animals to squeak.

Do not be satisfied with these accounts, but squeak every animal that has fur and feathers, for no one naturalist, no matter how vast his experiences may have been, can possibly learn all there is to be known about animals. As a field naturalist for the past fifty-five years, connected with many of the largest museums, zoological parks, scientific societies and expeditions, I have studied animals in every state but Maine. My Nature travels have taken me to northern Mexico, Alaska, and western and central Canada as far as Athabaska Lake, to eleven countries of Europe, a small part of Asia and much of Africa. Yet I learn something new nearly every time I go "Naturing." And, more often than not, "squeaking" is the reason.

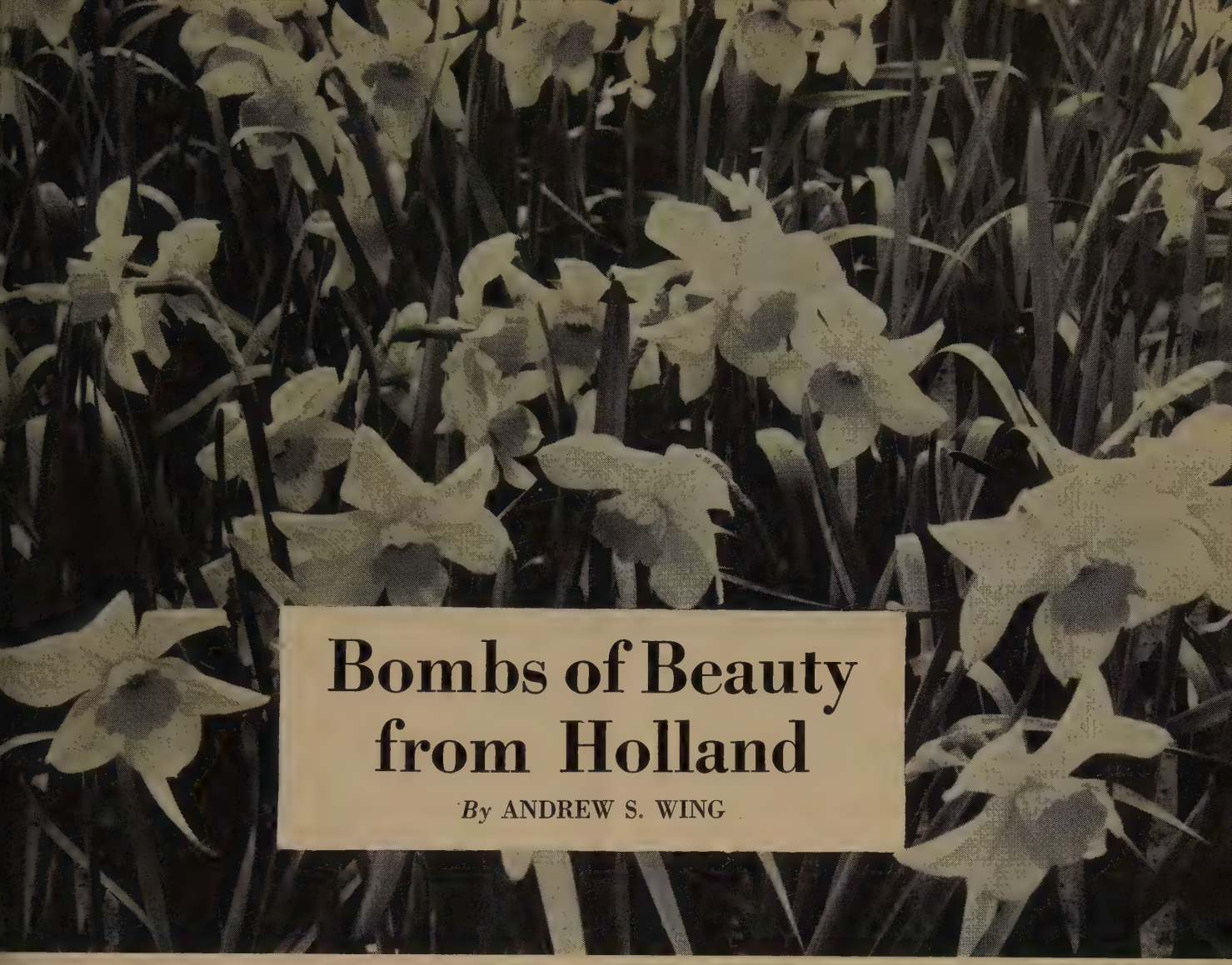
Gulls Inland

By JOHN GALLINARI WHIDDING

Wide wings, tide wings,
Come from the shore,
Circling over city streets,
Puzzled by the roar:
Nearly half a score.

Gray wings, spray wings,
Blown from the seas—
Banking over chimney-pots,
Wheeling in the breeze:
Stormy auguries.

Free wings, sea wings,
Leave where they fly
Tidings of the weather-change,
Scribbled on the sky
For the knowing eye.



Bombs of Beauty from Holland

By ANDREW S. WING

WHEN we think of Holland we think of tulips and broad-beamed Dutchmen in baggy trousers smoking clay pipes; or pink-cheeked children in wooden shoes; or quaint-looking women in lace caps and full skirts carefully polishing whitewashed doorsteps. And we were saddened to learn of the rape of the Low Countries, and the flooding of the rich farm lands by the Germans. We also mourned when we heard that tulips were being fed to cattle, or used on the table in place of potatoes.

We now know that these stories were exaggerated, and that, while Holland suffered greatly, the important bulb industry was saved almost intact. The Germans were too smart to destroy a goose capable of laying such golden eggs as tulips and narcissuses, which they exported profitably to Sweden, Switzerland and the home land. It is true that tulips were eaten, but not in large quantities, by hungry Hollanders whose plump frames had shrunken to gauntness. And the bulb districts could not be flooded because the lands lie above sea level, just behind the dunes that billow along the ocean front.

The Germans did try to restrict the production of bulbs in Holland during the war so that more food would be grown. But the canny bulb growers started expanding production in 1944—six months before liberation came—and right under the Nazis' noses. The shrewd Dutch farmers had saved the newer and better varieties and sold off the older and cheaper stocks. Thus they had fair amounts to export last year, and now, in 1946, scores of Holland bulb salesmen have been calling on the American trade again, offering their wares in abundance and with fall delivery guaranteed. These bulbs are said to be of excellent quality, and the prices are reasonable, in some cases less on new introductions than before the war.

It is believed that about 60,000,000 bulbs were imported from Holland in 1945, as compared with a normal prewar importation of 100,000,000. What the figures will be this year no one knows exactly, but it will be not far below the normal prewar supply. Some items may be short, but on the whole there will be enough of almost every kind of bulb for everyone. American growers have been making great strides in recent years, in an effort to compete with the Holland growers, so that any scarcities in the imported supply will be to a large extent made up by the domestic production. However, in order to be sure of obtaining a good selection, it would be well to order in advance of planting time just in case

This is a bulb farm in The Netherlands, although the cottage, with its large, surrounding trees and other setting, might be in our own mid-West or Northwest.

PHOTOGRAPHS COURTESY OF ASSOCIATED BULB GROWERS OF HOLLAND

some kinds should be short or late in delivery.

So grateful were the people of Holland for the food generously supplied them by the people of the United States, Canada, England, Russia, Sweden, Denmark, Irish Free State and Switzerland that a public collection was taken with which to buy tulip bulbs to send abroad as a gesture of gratitude. A national committee called "Flowers Interpret Netherlands' Gratitude" was formed under the patronage of H.R.H. Prince Bernhard, the President of the Royal Horticultural Society, and the mayors of the five largest cities. The spontaneous enthusiasm of the people resulted in the collection of $750,000 in cash from practically every man, woman and child in Holland. With this money 2,000,000 bulbs were purchased and distributed to the benefactor countries. A fitting touch was added when the bulbs were packed in the same boxes that had carried the much-needed food to Holland after the Nazis surrendered.

More than 300,000 tulip bulbs were presented to the City of Washington alone. These were planted in and around the Capitol Building, in Arlington National Cemetery, at the White House, the State Department, and the Supreme Court Building. Few Americans who saw these bright bombs of beauty bursting last spring were aware that they were the gift of the grateful people of Holland, who were rejoicing in their newly-found freedom from Nazi rule.

In New York City the Dutch tulips made exciting patches of color along Park Avenue, in Central Park, Van Cortlandt Park, and in other prominent locations. Notable was an outdoor display at the New

A front yard in The Netherlands flooded with row upon row of brilliant hyacinths. This is truly a lovely setting for any farm cottage.

Tulips are grown in long beds, great care being used in cultivating them. The stacks are salt hay, which is used as a winter mulch. The hedges serve as windbreaks for the tulips.

York Botanical Garden of 18,000 tulips, and 6000 in the greenhouses. National cemeteries at Baltimore, Maryland, and Farmingdale, Long Island, also received generous gifts of tulips. The people of Canada also enjoyed 300,000 gift tulip blooms in Ottawa, Toronto and Montreal. Most of the forty-five varieties sent to Canada were new to Canadian gardeners.

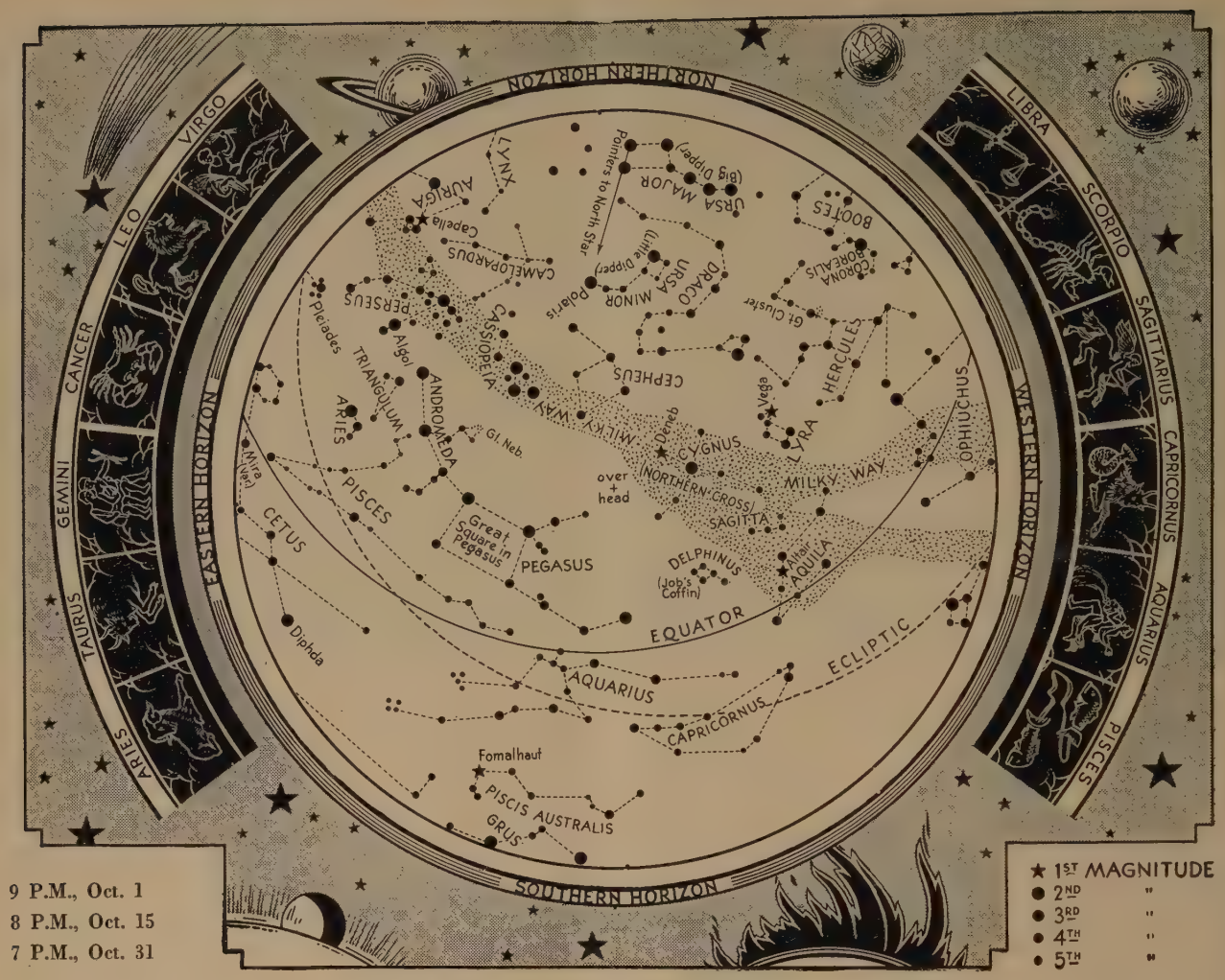
Tulips, however, fine as they are, are only one of many beautiful flowers that grow from bulbs. Bailey's *Cyclopedia of Horticulture* lists 119 species of bulbous plants that are procurable, while dormant, from dealers. Of these only thirty-five species are listed as hardy, the others being tender or semi-hardy. Bulbs are broken down into several groups—true bulbs, such as the tulip; corms, such as the crocus and gladiolus; tubers, such as the dahlia and potato; pips, such as lily of the valley; rhizomes, such as the bearded iris; and various other fleshy roots, including the peony.

Most of the bulbs we plant in the fall for spring or summer flowering are true bulbs or corms. A bulb is really an underground bud that stores up food for spring flowering. And that, of course, is one of its great advantages. With a bulb you buy a complete flower all ready to explode into bloom, in some cases even before the leaves appear. The foliage grows and stores up more food in the bulb for another year.

The size and condition of the bulb have a great deal to do with the size and number of flowers borne the next year. Small, runty, shrivelled or diseased bulbs will not give good results and should be shunned. The larger sizes are necessarily more expensive, and are commonly used only for forcing and exhibition purposes. For the home gardener, medium-size bulbs that are plump and healthy are best. Bulbs are propagated in various ways, but commonly by natural division. Or they may be cut into pieces and planted, or the scales torn away as with the lilies. This speeds up reproduction. In the garden the normal practice is to wait until the bulb divides itself into several parts, and these are then replanted in fresh ground. Otherwise the clumps will become crowded or "run out", and the number and size of the blooms will be greatly reduced.

Tulips are not as durable in the garden as some other bulbs. Unless they are taken up every two or three years they will fade out of the picture, and for best results they should be renewed every other year or so. Daffodils, jonquils, and, indeed, almost all members of the narcissus tribe are hardy and long-lived. Divide up the clumps whenever they become crowded; plant in fresh soil, or fertilize carefully, and they will prove as permanent and as satisfactory an investment in garden material as you can make. Whether planted in the hardy border between other plants, or naturalized in the grass along a brook or in a wild corner of the garden, daffodils and jonquils are always gay and interesting. Since these bulbs are so permanent it is always best to buy good stock of the better varieties to start with. The Poets Narcissus type, with its airy, wild-flower look, is fine for naturalizing, while the larger types fit more appropriately into the general garden scheme.

Hyacinths are hard to beat when it comes to color, and, therefore, they make grand bedding plants, although a bit stiff for cutting. The tiny, blue, grape hyacinths are really indispensable in the low border for early bloom, and so are the snowdrops and all the rest of the small, early-flowering bulbs. Crocuses deserve as much space as you can give them, both as harbingers of spring and for sheer beauty when everything else is bare (Continued on page 442)



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

October May Provide Meteor Show

By ISABEL M. LEWIS

METEORS, following in the path of the faint comet Giacobini-Zinner, may produce an exceptionally fine display in the early morning hours of October 9-10. In 1933 an average of 400 meteors a minute were recorded in connection with one of the periodic returns of this comet, and conditions for a recurrence of such a display, under much more favorable circumstances, exist this year.

Comet Giacobini-Zinner bears a double name because it was discovered by Giacobini, in 1900, and rediscovered by Zinner in 1913. It has a short period of 6.6 years, and has been observed at returns in 1913, 1926, 1933, and 1940. Only in 1933, however, were conditions favorable for the observations of the swarms of meteors that follow in its wake, scattered along the orbit to distances of many millions of miles from the comet itself. In that year the comet preceded the earth by eighty days, according to information in the Handbook of the British Astronomical Association, while the point of nearest approach to the earth of the path of the comet, along which the meteors are traveling, was 500,000 miles. On October 10 the comet will be ahead of the earth by only eight days, and will then be about 30,000,000 miles from the earth. Its orbit, however, will be only 135,000 miles from the earth on that date, or a little more than half the distance from the earth to the moon. Swarms of meteors traveling along the comet's path should, therefore, be encountered by the earth in much greater numbers.

How many meteors will be met will depend upon how widely they are scattered along the path of the comet, and on how great a distance the swarm extends to either side of it. The only unhappy circum-

stance connected with the expected display of celestial fireworks will be the presence of a full moon at the time. This may be expected to blot out the light of all but the brightest meteors in its part of the heavens. Best observations should be obtainable in the early hours of the morning on October 9-10, when the moon is near setting. It will be, at the time, in the constellation of Pisces, while the radiant of the swarm—or the direction from which, as a result of perspective, the meteors appear to radiate—is located in the head of Draco in the northern sky. The individual members of this swarm are named Giacobinids, after the comet and its discoverer. It is not expected that the comet itself will be visible, except telescopically, because of its extreme faintness even when nearest the earth on September 20. It will then be at a distance of about 24,000,000 miles from the earth in the constellation of Gemini. It is at that time moving so rapidly southward that it will pass into Canis Major before October 15, and nearly through it before the end of the month.

Most small, short period comets that make many trips around the sun disintegrate rapidly, and their debris is scattered along their orbits. These produce, when the orbits pass near the earth, the periodic swarms of meteors, such as the Leonids, Lyrids and Perseids, named for the constellations in which their radiants lie. Others, such as the Bielids and Giacobinids, are named for the comet along whose orbit they travel, and of which they are the debris. In some instances they may be distributed quite evenly along the orbit, as with the Perseids. Then displays of equal strength will occur each year. Again, as is the case with Leonids, or November meteors, which occur in much greater numbers at intervals of 33 years, it appears that the meteors are bunched together more closely in some parts of the orbit.

A number of great meteoric showers have been identified as returns of members of this swarm. The greatest of all known showers was one of the Leonids that occurred on November 12, 1833, when the number observed over a period of six hours in different places was estimated to average as high as 200,000. Another great shower of Leonids was observed on November 13-14, 1866, although it was not as spectacular in appearance as the one of 1833. It was predicted by H. A. Newton in 1864, who found, from examination of old records, that a number of great showers of meteors had occurred in the past at about the same time in November, which would be when the orbit in which they were traveling passed near the earth. So extended was the great shower of 1866 that it required more than a year to cross the earth's orbit; for another shower of great strength was observed the next year at the same time in November. It was found that the swarm moved in an elongated ellipse with a 33-year period.

A great shower of Leonids was confidently predicted for November 14-15, 1899, or the following year, but no noticeable shower appeared in either year. Later it was discovered that the probable reason for the failure of the swarm to appear as predicted was a result of perturbations of the orbit of the swarm by the planets Jupiter, Saturn and Uranus. This caused the greater number of the meteors to be drawn aside from the earth's orbit by a distance of more than 2,000,000 miles. So keen was the general disappointment in the failure of this astronomical prediction that the prestige of the astronomer suffered a severe blow, making him extremely cautious when it comes to making predictions having anything to do with meteors. So the only statement forthcoming regarding the swarm of meteors due to appear on October 9-10, or thereabouts, is that it may be exceptional due to the close approach of the orbit to the earth at a time when the comet is only eight days away. The unfavorable circumstance of a full moon at the critical time is also stressed.

It is always a question how great will be the concentration of meteors at any one point along the path of a comet in which a stream of meteors is traveling. Also it is uncertain how widely they may stray to either side of the path, and whether this is far enough for them to reach the earth and be swept up by its atmosphere. This probably varies considerably with different swarms, the size of the comet, amount of debris and other considerations.

The position of the orbits of meteors are difficult to determine accurately because their motions are affected seriously by the passage of the swarm close to a major planet. The 1939 orbit of the Giacobinids has been corrected for the perturbations caused by the planets Jupiter and Saturn, and the fact of the very close approach of the orbit to the earth seems to be well determined. The fact that in 1933 a fine shower averaging 400 meteors a (Continued on page 439)

The Night Is Music

By COSETTE MIDDLETON

The night is music and its haunting theme
Is moonlight in the forest, black and gold;
Its lyrics spring from feathered throats that dream
On frosty boughs, unmindful of the cold.
The wind is dancing on October-sandals,
Leaving its burnished footprints where it goes;
The sky is vigilant with astral-candles,
And silence yields to whispered tremolos.
The night is music—music we have known
A lifetime, never questioning its source,
Rooted in genesis, primeval-blown,
And shadows understand its rhythmic force.
The night is music, autumn-wise and deep,
Lulling the universe and man to sleep.

The School Page

Edited by E. LAURENCE PALMER

Professor of Rural Education, Cornell University, and Director of Nature Education, The American Nature Association

MOTHS AND BUTTERFLIES IN SCHOOL

NOT MANY years ago a learned educator proposed that a study be made to determine the relative amount of space given in elementary school texts and outlines to the monarch butterfly and to the cabbage butterfly, and to get a definite statement as to the number of communities selecting each of these lepidopterous insects as representatives of their group. The assumption was that one could judge the relative importance of the two insects by the frequency and extent to which they appeared in material designed to help the teacher.

Even though such a ridiculous study had been made, it is doubtful if the findings would have been presented on this page as significant. The species to be used as representative of this group of insects should be determined by the species locally available at the time they are to be studied, and not by the laziness of writers of text-books and study outlines whose information may be limited to only one of these two species. One could hardly support the study of the cabbage butterfly in January in Iowa, although that state's outline in elementary agriculture once proposed it.

While we cannot here recommend the study of any particular species at any time and place, we can hope that there are few times and places where none of the species presented in the special insert in the center of this magazine is found. While we should not have recommended the study of any particular species, we can suggest a number of things that may be useful in understanding any moth or butterfly at any time or place.

Among the common school activities associated with these insects are the following: Collections of the adults, and of series representing the stages in the life histories of the different species; collections illustrating the favored foods of the different species, and the type of injury caused by the insects in taking these foods; circular charts showing the relative length of time spent by the insects in their various stages of development; charts and graphs showing the position, above or below ground or elsewhere, of the insects through the year and emphasizing when control measures may best be put into effect; exhibits or charts showing the steps in processing some of the things of economic importance that can be had from some of these insects, particularly the steps in the production of commercial silk from the silkworm; exhibits of crafts in which parts of brilliant butterflies are used effectively in jewelry and elsewhere; exhibits of rearing cages and other devices for restraining the wanderings and keeping off the parasitic enemies of species that interest the student; collections of recommendations for measures designed to destroy harmful species; collections of useful references on this group of insects; card indexes showing where helpful material may be found in the literature available locally on each important local species; essays telling of phenomenal destructions that may have been caused by these insects in the past; summaries of the laws governing the local control of different species, as is the case with quarantining of different areas to prevent the spread of brown-tail moths or gipsy moths; interviews with old residents of the community to provide an historical record of any phenomenal epidemics that may have been associated with the insects; exhibits of these insects showing how they may have been controlled by their own natural parasites; exhibits showing the use of moths or butterflies as suggestive themes in conventional art or in costume designing; exhibits of kodachromes of the more beautiful lepidoptera, and so on and on.

Space here does not permit the elaboration of all of these suggestions, and the alert teacher will need little more than the suggestion. However, any school pretending to study these interesting animals should have a variety of rearing cages available at all times to take advantage of any opportunity that may arise. One of the simplest of these is provided by the ordinary screened window. Cocoons that may be brought in by the children may be pinned to the inside of the screen where they may get a normal temperature and humidity experience and where emerging adults may be held captive with little difficulty. In some cases it may be well to provide narrow, earth-filled boxes that fit between the window and the screen for the protection of species that may burrow in the earth for a part of their life cycle. It may be simpler, in such a case, to fill an old pail with earth in which the larvae may be permitted to burrow, and, with the help of the earth in the pail, place a wire cylinder above the pail so that emerging adults may be kept from escaping. Lamp chimneys, with their bases set in earth in a flower pot and with their tops covered with cheesecloth, make excellent breeding cages for many lepidoptera that burrow in the earth for a part of their life history. These can be set on the window sill with the ordinary house plants and occupy little space for the amount of interest they may provide.

Schools that may become moth and butterfly minded will eventually need more elaborate breeding cages. These may be made by stretching ordinary screen wire over a frame that is a foot or more on a side, and about a yard long. The bottom may be tacked to a box containing earth and the top may be covered with cheesecloth, which may be removed for adding necessary food or for handling the confined insects. A few years ago my assistant started in with a few luna moths, which she reared through the year, and so intrigued our office secretary that she "borrowed" a few surplus cocoons and started a series of her own, even though, at the beginning, she had what she thought was the orthodox feminine horror for "worms." Now both of these ladies have stock that they have reared over a period of years. Another visitor to our office became interested, and began photographing what was going on, and a correspondent, who heard of the story, started in exchanging experiences and photographs of the pets. This leads me to believe that one of the best ways to get youngsters started in studies of this sort is merely to establish something like a breeding cage, and trust to the curiosity of the students to enter into the game. It might be fatal to insist that every student make and maintain a breeding cage. Leadership provides a better basis for a substantial interest than does dictatorship.

School

By MAE WINKLER GOODMAN

He never learned the alphabet
From any text or book;
He learned to write a simpler way:
By copying a brook.

A stranger to geography,
He found, in leaf uncurled,
A vaster Atlas kenneled there
Than all the mapless world.

And man's ensanguined history
Of empires lost, or won,
He scanned, instructed by the moon
And tutored by the sun.

All secrets cored deep in the earth
No science would impart
He knew, who memorized the hills,
And learned the world by heart!

Teachers of English, and of art, may find many helpful bits of inspiration from the moths and butterflies. Shakespeare, in his *Midsummer's Night Dream*, brought in Queen Titania, who, in the dramatic presentations of the play at least, has what look like wings of butterflies. Possibly this helped set the style for the use of butterflies' wings as means of locomotion for the fairies, although probably the idea goes for its roots to pre-Shakespearian times. It has amused me that, in the stage presentations I have seen of this favorite play of mine, the costume makers sought their inspiration for costumes from the diurnal butterflies when they would have found equal beauty and a more appropriate atmosphere had they looked at luna and cecropia moths for suggestions. There probably is not an elementary school child who does not at some time see a school play in which he or his friends appear with butterfly wings. Usually these stage props are provided by the art teacher, or the overworked general teacher. How much easier it would be for these teachers if they merely turned to a collection of moths and butterflies that has been collected, and set the children to work making their wings to resemble the unexcelled designs provided by Nature?

Rare Mexican Tree

In the May, 1946, issue of the *Journal of the New York Botanical Garden* Margaret Douglas describes the *Huanita*, a fragrant tree she found blooming in the courtyard of a ruined chapel at Santa Cruz de las Flores, Mexico. Delving into the botany and history of the tree, Mrs. Douglas found that it is extremely rare, that its scientific nomenclature is, to some extent, mysterious, and that it is surrounded by several fascinating legends. Although at least one of these legends dates from Hispanic times, others, as well as such history as can be found, are of pre-Hispanic date. One story has it that a war was fought for the possession of one of these trees, which is a different cause for war, at least. Suffice it to say, the *Huanita* is a rare tree, and a beautiful one.

Desmond Arboretum

In 1939 Thomas C. Desmond, New York State Senator, established an arboretum at Newburgh, New York, from which the visitor may look down through the Highlands of the Hudson toward West Point. This reservation was closed during the war, but now is open daily to visitors without charge. Permission may be obtained by writing to or calling at the office of Senator Desmond, 94 Broadway, Newburgh, New York, or by getting in touch with the Arboretum Superintendent, Rudolph M. Nocker.

OCTOBER MAY PROVIDE METEOR SHOW

(Continued from page 437)

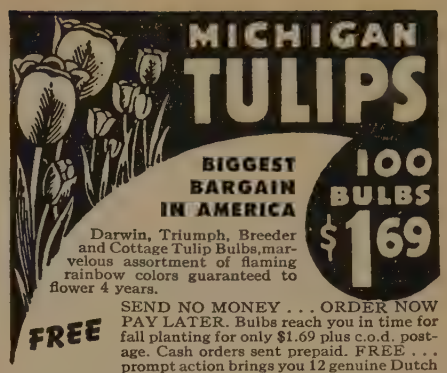
minute for several hours was observed when the comet preceded the earth by eighty days, and when the nearest point of the orbit to the earth was 500,000 miles distant, would seem to be an indication that, with the nearest point only 135,000 miles away and the comet preceding the earth by only eight days, a much more remarkable shower than in 1933 might reasonably be expected, even by the most cautious prophets.

Comet Giacobini-Zinner was rediscovered at this return by Dr. H. H. Jeffers of the Lick Observatory, Mt. Hamilton, California, on May 29. It is a faint, diffuse object visible only in the telescope. Its closest approach to the sun will occur on September 18, when it will be at a distance from it of a little less than 93,000,000 miles in the direction of the earth, but above it.

In the month of October all of the planets except Saturn will be in the evening sky, although poorly placed for observation. Mercury will be at its greatest distance east of the sun on October 31, but even at that time will be in an unfavorable position, low in the southwest. Venus will be at its greatest brilliance on October 13, but will be low in the southwest. It will be in conjunction with Mercury on October 31. Mars will be too close to the sun for observation in October. It will be in conjunction with Mercury on October 20. Jupiter is too close to the sun for observation this month. It will be in conjunction with Mercury on October 10, and with the sun on October 31. Saturn is visible in the east shortly after midnight, and is near the meridian, in Cancer, at sunrise.

Forests and Jobs

If the productivity of our depleted forests and run-down ranges were restored, and other resources of the forests fully developed, the nation's forests could create 2,500,000 new and permanent jobs, according to Lyle F. Watts, Chief of the U. S. Forest Service, in his annual report. Mr. Watts says that, directly or indirectly, the forests now provide about 3,750,000 jobs. He advocates a comprehensive forestry program, including nation-wide regulation of timber cutting and related forest practices as assurance that the nation's forests shall be kept reasonably productive; public ownership of millions of acres that private owners find unprofitable to hold, or on which watershed, recreation or other public interests outweigh the interest of a single owner; increased government assistance to private forest owners.



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Camera Trails

By EDNA H. and WILLIAM J. EVANS

PERHAPS we were a little too harsh last month in writing about vacation snapshots and photograph albums. It is not that we do not approve of them—far from it. It is just that we get tired of the monotony, and the everlasting cluttering up of naturally beautiful scenes with poorly posed people.

But a lot of originality can be used in snapshots, and photograph albums can be great fun to look at, and even greater fun to make. We have done some work on two albums that we prize. One is titled "Up The Family Tree With Fun And Camera" and the other we call "Around The World Without Leaving Town."

"Up the Family Tree" was inspired by memories of the real old albums that Grandmother used to keep on the parlor table —albums and parlors the like of which we have not seen since before the dentist took the wires off our teeth. Lacking a real one, we decided to prepare our own family album, selecting the ancestors we liked and leaving out the uninteresting ones.

First we posed Mr. and Mrs. Snagtooth Ugg, leaders of cave society back in 20,000 B.C. While they seem to be having a little argument in the resulting picture (with a hog jaw as the bone of contention), Snagtooth's fist is not clenched to wallop the little woman. Instead, he is pulling the string that released the shutter and took the picture.

Next came Ptolemy and Cleopatra, just home from a vacation trip to the Pyramids. Then Salome of Salonika in flowing Grecian draperies, and Brutus Maximus, the noble Roman who helped Caesar divide all Gaul into three parts. Both Salome and Brutus are garbed in bed sheets.

Thus far, we have omitted Sir Ivanhoe Ironpants of Fallen-plaster on Floor. He rode with Richard the Lion-Hearted on the Third Crusade, but, until we have energy enough to build him a suit of armor out of cardboard, he will have to remain a blank page in our album.

But from the days of bold pirates and bloody buccaneers we have Captain Applejack Demijohn, posed with cutlass and doubloons—the latter "prop" was borrowed from a coin collector who lives next door.

Brigadier-general Beauregard Battle was a big shot back in Civil War days—he posed for us after (long, long after) Gettysburg. And we must not forget Cousin Emmaline Letitia, divided-skirt and women's rights leader of her day. She is shown in our album addressing a suffragette meeting.

Mr. and Mrs. Snagtooth Ugg caught by the camera during a slight family disagreement.

This "desert" scene shows how it is possible to take a trip around the world without leaving the old home town. The "props" are part of a Christmas tableau.

There are many others. For example, Auntie Florabelle who was a lion tamer under the big top. She posed with a kitchen chair—after giving her lion the afternoon off. Then there is Cousin Eustace Algernon, black sheep and remittance man of the family, posed with native girl friend on the bench at Beri-Beri, and Uncle Pancho, that satin Latin who was one of Villa's chief machete men and quite a cut-up south of the border.

These are only a few of the "ancestors" to be found in our family album. Creating, costuming and photographing them has given us a great deal of fun.

AROUND THE WORLD

As for that trip around the world without leaving the old home town—it was easy, too, and anybody can do it. It is a good idea to take advantage of whatever natural scenery is available, but even this is not necessary. Almost any scene can be faked, as Hollywood proves a dozen times every week.

A couple of ordinary sheets will serve many purposes. They may be the gleaming sands at Waikiki, or the snow-capped crest of Mount Everest. Cleverly-arranged deck chairs, with a few odds and ends of nautical properties, will put you aboard a ship bound for anywhere.

The weedy lot next door easily may pass for the African veldt (just do not have any houses showing in the background) while any small clump of pines will shelter your camp in the Great North Woods. The heaped-up earth along a ditch or drainage canal, if photographed from the proper angle, will make a first rate mountain background.

We waited several months in order to take our favorite desert scene. Actually, the sleepy looking camel belongs to one of the Three Wise Men, a display set up in our town each year at Christmas time. One noon, when no one was around, we took our pictures.

Costumes are important, of course. But boots, breeches and a sun helmet will serve to identify a jungle explorer, while shorts, some fancy suspenders and a coil of rope will make an Alpine climber. A change of hats will transform a kimona-clad Chinese coolie into a haughty mandarin, while the gay caballero wears sombrero and serape and strums a guitar.

And so around the world you can go—Russia, China, India, Arabia, the heart of Darkest Africa, Mexico, Switzerland, Alaska—any place you care to visit and can supply the properties and costumes for.

So, in view of all this, we are sorry we criticized people last month for showing off their snapshot albums. We do the same

From the days of pirates and buccaneers comes this sprig from the family tree, Captain Applejack Demijohn.

Auntie Florabelle, the lion tamer. She posed with her kitchen chair after giving her lion the afternoon off.

thing at the slightest provocation.

HOT WEATHER BOON

A boon to those who try to develop film in hot weather, and who do not possess the luxury of an air-conditioned dark room, is the new Kodak Hi-Temp hardener solution. This makes film processing possible at any temperature up to 95 degrees Fahrenheit. Normally, film should be processed at temperatures below 75 degrees, for best results.

Before being developed, the film is bathed in Hi-Temp for from six to ten minutes, and is then developed in the usual manner with no danger of emulsion softening or reticulation. It is easy to use and the other formulas—developer, rinse and fix—remain the same. For anyone who has struggled with ice, or cubes from the refrigerator, during hot weather sessions in the dark room, the hardener is a real and undisguised blessing.

NEW EQUIPMENT

Among the releases describing new photographic equipment received recently is one telling of a new plate and film developing tank, and another about a sturdy new tripod.

Special features of the seamless, molded bakelite developing tank permit it to be loaded in darkness or under a safe-light, and used thereafter in full light. Light-tight pouring and drain vents permit the tank to be emptied or filled in thirty-two seconds. Solution capacity is half a gallon. The new model is CF-46, made by Price Industries Corporation, 18 East 41st Street, New York, 17, N. Y.

The tripod, a product of Alco Photo Supply Company, 17 West 47th Street, New York City, is made of aluminum, steel and bronze. Although it weighs only fifteen pounds, it can support a weight of two hundred pounds without vibration. Maximum height is six feet, three inches, and minimum height is thirty-five inches. While it is too big for the average amateur, it can be used to advantage by studio and commercial photographers.

CAMERA-CONSCIOUS VETERAN

In addition to the changes it has brought about in camera equipment, the war also has produced a bumper crop of trained photographers. In talking to a representative of the United States Employment Service recently, we learned that the veterans' division of that organization has more applicants for photography jobs than it can cope with. Ex-Navy men, especially, seem to want photography jobs, the representative said.

This rather startled us, until we looked around at our own town of some 30,000 people. During the war it limped along with one languidly operated camera shop and one overworked developing service. Now a new shop has been opened, a second developer is making a bid for business, the original shop has moved to a better location, added new lines and shaken off much of its lethargy.

An ex-Signal Corps officer, formerly in the radio business, has shifted to photography and opened his own shop in a nearby town. Why? Because he thought photography was destined for steady growth while television might come along and upset the radio applecart at any time.

We hope that all these G. I.-trained photographers will continue their interest in photography, regardless of whether or not they find places in the business.

WANTED

Comments, criticism and suggestions as to what photographer-readers of this department would like to see here.

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BOMBS OF BEAUTY FROM HOLLAND

(Continued from page 435)

and brown. You do not need to worry about the crocuses except that, if planted in the lawn, mowing should be retarded until after their leaves have started to mature. Crocuses have come to us mostly from Holland, and it will be nice to have them back again in good supply. If you do not know the different types, including the autumn blooming species, try a generous assortment. Their cost is low compared to the pleasure that they give you.

In selecting tulips or other bulbs for planting a reputable dealer's catalog, illustrated in color, is as good a way as any to make a choice. There are any number of good new varieties on the market, in addition to the old stand-bys. First decide the type you want and the color range; then make up your list according to height, color, type and the number of bulbs needed. Mixtures and collections are economical to buy, but if a definite color scheme is desired it will be better to stick to the named varieties. Bargain-counter bulbs seldom pay because they will usually be small or diseased, or otherwise inferior in quality.

Aristocrats of the border are the lilies, whether they are short or tall, early or late in flowering. Unfortunately, many of the best lilies are rather fussy as to soil and location, and they are susceptible to plant diseases. They require a well-drained, fertile soil and resent being pushed around by other plants. So give them space and light and air. Not all lilies are hard to grow, however, and such varieties as the Madonna, Tiger and Umbellatum are quite durable and decorative if given reasonable care. Almost as handsome as the true lilies are the day lilies, or hemerocallis. These are of the easiest culture, multiply rapidly and now come in all kinds of intriguing shades of yellow, brown, orange and red.

And without seeming to drag a lovely flower in by its heels, or its rhizomes, to be exact, permit me to put in a plug for the iris family. There are bulbous irises that are hardy, although most of them are not, but in the German, Siberian, Japanese and native species (to use their old names) are hundreds of varieties of the most exquisite colors, patterns and shapes. Late summer or autumn is the best time to transplant most irises, and if you have not added any of the newer and better ones to your collection by all means do it now. Peonies, too, should be considered in bringing the garden back to its prewar pink of condition, or in planning a new garden. There is no hardier or more enduring flower than the peony. Plant a healthy clump in a good spot, give it a minimum of care and a little plant food every year, and you will have an investment in garden beauty that will pay you spiritual dividends every season for a lifetime or longer. Here again it is important to choose good varieties of the iris, the peony and other long-lived perennials. For once you plant them, they will be permanent guests in your garden, or at least most of them will be.

Directions for planting can be found in almost any bulb catalog or garden guide. The soil should be well prepared and fertilized. Depth of planting will depend on the type or size of the bulbs, and they must be properly spaced. In naturalized plantings a good way is to scatter a handful of bulbs over the ground and to plant them where they fall. In that way the spacing will seem as natural as it should be in a wild setting.

The Dutch bulbs are back, and offer a fitting way to celebrate the peace together with our friends overseas, where so many of our American lads were left behind never to return.

CONE YEAR

(Continued from page 412)

the year-round olive-green and gray of their mates.

Small nutcracker bands roamed the February pine flats. Rarely, a little, swirling flock of redpolls was seen showering out the tiny, double-winged seeds of pendant birch cones and patronizing streamside alders. But the mild winter weather brought few of the hardy northerners. Crossbills now were favoring the long-bracted, papery-scaled cones of Douglas firs, for, with recurrent rains, these storehouses did not swell and close so impregnably as did the heavy-scaled fruit of the pines.

All this abundance contrasted markedly with the preceding year of scarcity among evergreens of the region. Then no single nomad crossbill had appeared, no raucous pine-crow crew ventured down the valley flats and benches; even red-breasted nuthatches, after years of uninterrupted residence, vanished through the lean season. From a hundred miles away among the ranges came like report from a friend: "Nary a nutcracker or pine grosbeak here; only a few scattered chickadees; a few stray Rocky Mountain nuthatches and no red-breasted at all!"

Yet the memorable harvest that began months before with the lazy haze of Indian Summer was not over. The final gift of the pines was still to come.

Mid-March was fast departing with its swiftly retreating snow patches when a seeming flood of white and gold, black and tawny, rising on a tide of wings, attracted me to the spot where I had watched the chickadee-nuthatch carnival. Seventy or eighty evening grosbeaks, forgetful of the mountain maple keys that had been their winter fare, were foraging upon the pine flat. Although I approached still closer, these rangers of the midzone and high forest levels soon began dropping gracefully back in scores to the ground. There the multitude of big, parrot-like hawfinches, duller females among the gaudy males, presented a picture for speculation and wonder. Hopping awkwardly about over the kinnikinnic, and amid the dead bunch-grass tufts, they were avidly searching the pineland floor. Black-cap and mountain chickadees scattered among them, and a midget pigmy or black-eared nuthatch, all absorbed like small boys in the hunt.

Again and again I strove to make certain identification of the damp, dark-brown seed-nuts the grosbeaks twirled in their great, shearing bills. Like a flurry of the warm March wind, a dozen crossbill visitors swept down at the flank of the flock, bringing in their company the first purple finch of the season. Presence of the crossbills here, gleaning on the needled wood-floor, should have been proof enough that pine nuts, winging long since from ripened cones and spilled by autumn feasters, again were luring the feeding flocks.

Yet I persisted, studying intently with the glasses. Fifteen feet away, between a green-brown carpet of kinnikinnic and the melting edge of a snow patch, one friendly red crossbill juggled a round seed in his curious beak. The spot was easily marked—and I found there two neatly split halves of a pine-nut shell. Long mantled beneath the snow, last season's harvest was still spread upon their board. Autumn had passed in feasting; winter had come and gone in plenty; yet, with the vanishing of the old year's snows, was renewed the bounty of cone year along the Kootenai!

Nature Recreation

"Enjoying Nature" is the title of a helpful 40-page booklet published by the National Recreation Association, 315 Fourth Avenue, New York 10, New York, and available at 65 cents a copy. It contains advice on the establishment of Nature Centers, Nature Trails, and Trailside Museums.

ANSWERS TO INSECT QUIZ

1-K, Harvestman—Daddy-long-legs; 2-F, Punkie—No-see-um; 3-P, Termite—White ant; 4-M, Locust—Short-horned grasshopper; 5-B, Praying mantis—Soothsayer; 6-R, Lacewing fly—Aphis lion (their larvae); 7-L, Dragon fly—Darning needle; 8-O, Cicada—Seventeen-year locust; 9-Q, Aphid—Plant louse; 10-N, Hour-glass spider—Black widow; 11-D, Silver fish—Fish moth; 12-G, Cockroach—Croton bug; 13-A, Mayfly—Lakefly; 14-H, Louse—Cootie; 15-E, Kissing bug—Masked bedbug-hunter; 16-I, June bug—May beetle; 17-C, Tumble bug—Dung beetle; 18-J, Engraver beetle—Bark beetle. 1-K (Harvestman—Daddy-long-legs) and 10-N (Hour-glass Spider—Black Widow) are the non-insects.

THE READER'S MARKET

A place where members of the American Nature Association and readers of Nature Magazine may find many interesting offerings, or may advertise themselves, at low cost, for things wanted; things they have for Sale, for Trade, for Sale or Trade. This is an excellent forum for acquiring or disposing of such items as binoculars, books, cameras and photographic equipment, magazines, sports and outdoor equipment, etc.

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6. *"For Sale" ads must state prices:* A specific price must be stated on all FOR SALE ads —except that the phrase "write for catalog" may be used when listing real estate or merchandise in quantities.

7. *Conditions of trade or sale:* The condition of binoculars, cameras, instruments, other equipment useful to outdoor lovers, home-owners, etc., advertised for sale or trade must be specified as follows: PERFECT—meaning factory condition; EXCELLENT—meaning new condition, implying negligible amount of use; VERY GOOD—meaning practically new condition, implying little use, with no appreciable wear and only minor surface scratches or wear; GOOD—meaning moderate condition and with only moderate wear; FAIR—meaning no parts missing necessary to use, reasonable wear inside and out; POOR—meaning marred appearance or badly worn.

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9. *Blind ads not acceptable:* Box number or blind ads will not be accepted. Give your complete name and address to insure prompt delivery of all mail or telegraph replies.

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BIRDS OF SHAKESPEARE

(Continued from page 416)

It was once believed that while the Halcyon, or kingfisher, was hatching her eggs, the water remained calm, and this period was called "Halcyon Days" as in *Henry VI:* "Expect St. Martin's summer, halcyon days." The swallow, known for its swiftness of wing, occurs in *Richard III:* "True hope is swift and flies with swallow's wings." In *Timon of Athens:* "The swallow follows not summer more willingly than we your lordship." *Winter's Tale* yields: "Daffodils that come before the swallow dares." The poet several times uses the heraldic term for the martin, which is "martlet," once in *Merchant of Venice:* "The marlet builds in weather on the outward wall."

Three exotic birds are given attention by Shakespeare—parrot, ostrich and pelican. Parrots are supposed to become restless before a rain, hence, in *As You Like It:* "More clamorous than a parrot against rain." Because a parrot is supposed to be rewarded in teaching it to talk, we find, in *Troilus and Cressida,* Act V, the line: "The parrot will not do more for an almond."

The reputed extraordinary diet of the ostrich is given recognition in *Henry VI,* Part II: "I'll make thee eat iron like an ostrich." As to the pelican, the best-known legend is that it feeds its young with its own blood, and in *Richard II* John of Gaunt exclaims: "That blood already, like the pelican, hast thou tapp'd out, and drunkenly carous'd." In *Hamlet,* Laertes says: "To his good friends this wide I'll open my arms; and, like the kind, life-rendering pelican, repast them with my blood."

For last I have reserved one bird, frequently unpopular as an immigrant to America, but a beautifully marked, chattering, bold, fussy and ubiquitous bird—the starling. These birds often used to be taught to talk. Hotspur, in *Henry IV,* Part I, referring to Mortimer, declares: "Nay, I'll have a starling shall be taught to speak nothing but 'Mortimer,' and give it him to keep his anger still in motion." This is the only reference to this bird throughout the works of Shakespeare. Perhaps he did not like the starling either!

THEY GROW LARGE ON OKINAWA

(Continued from page 429)

ting to be needlessly torn. While there are few things that creep, crawl or fly that she does not accept as provender for her larder, there are instances when she loses no time in releasing the unwanted. She does this in a way that suggests some sense akin to reason. Her webs are built off the perpendicular, so that a falling object will break as few strands as possible on its downward track. The worth of this "off center" snare was demonstrated when a friend of mine tossed a six-inch lizard into the web of one of the larger spiders. The net strands seemed able to hold the struggling reptile, but the web owner hurried down and began to spin out broad bands of silk. These she deftly wound about the luckless lizard with a bobbin-like movement of her right rear leg.

In a surprisingly short time the victim was so completely bound that it could do no more than vibrate its slender neck. Then the spider, after pausing a moment to survey her work, deliberately began to sever, with her jaws, all the web strands beneath the shrouded bundle, letting it hang free. This done, she severed strands to the right and left of the two upright ones supporting the load. Then, taking a position above them, she cut the remaining ties, thus permitting the lizard to fall to the ground. Next morning the hole in the net was repaired.

One morning, shortly after we set up camp near the native village of Kin, a Seabee came to me with the information that a "great, long-legged bug" was in th post-office tent. Thinking of some large beetle, I hurried over and was startled to find the largest *Scutigera* centipede I had ever seen. The creature, fully six inches long, surrounded by thirty very slender, yellow-jointed, hair-like legs, seemed actually to float across the side of the tent canvas, holding its brown and jointed body two inches away from the cloth. I captured the creature in an empty tomato can with as much care as I could. But even at that, several of the legs were detached, and kicked about for some minutes in the bottom of the can before I could talk the medicos into giving me some killing agent.

During June, July and August, other similar centipedes were found, usually in moist and shadowy places. They all seemed about the same size. But one day, exploring a natural cave overlooking the bay called Ora Wan, I found one of these giant kin to the "damp bugs" in our southern states, just after it had completed a meal of a cave cricket on the cavern ceiling. Apparently paying no attention to the light of my pocket torch, the centipede went calmly about its toilet, drawing each slender leg through its jaws until all thirty had been attended to. Then, as though touched with a hot poker, the myriapod shot across the ceiling stalactites so swiftly it lost its hold and dropped to the floor. There it ran behind some earthenware jars in which native Okinawans had placed ancestral bones, and I saw it no more.

There was a host of common centipedes on Okinawa, too. But usually they were smaller and shorter than some I have observed on the Texas plains. Nevertheless they were always about, and far too "friendly." One of the first things a man did each morning was to shake his clothes thoroughly. I learned this trick the hard way, for one morning a four-inch centipede went to breakfast with me, and I did not discover its presence until the two of us had traveled together a half-mile. From then on, there no one was more careful about shaking his garments at reveille than myself.

THE WOLVERINE

(Continued from page 428)

species that have passed away within the past hundred years. Shall the wolverine be added to the list?

If we are to prevent the extinction of this interesting animal, it will be necessary for such agencies as the U. S. Fish and Wildlife Service, National Park Service and U. S. Forest Service, and such organizations as the American Nature Association, Committee for International Wildlife Protection, Izaak Walton League, National Audubon Society, National Parks Association, Wilderness Society, and other conservation groups, to sponsor wolverine research, and to campaign for areas where the animal may live in safety.

However, more protection than this interesting species is now getting is possible without waiting for the slow and uncertain process of establishing special reserves. In several of our National Parks, already dedicated to the preservation of the resident wild creatures, there still occur representatives of this species. These reservations are Mount McKinley, Mount Rainier, Glacier, Yellowstone and Rocky Mountain National Parks. Rigid enforcement of the regulations against trapping probably would constitute the only help needed for this resourceful animal. A very desirable activity would be more extensive studies of the mammal fauna of all our National Parks, with special emphasis on the ecology of the entire biota.

Legislation to minimize the exterminative activities of trappers would require local action in States and Canadian Provinces where wolverines are found. These laws might be difficult to pass and enforce, but they would prolong the time during which these solitary and stout-hearted creatures of our northern forests may survive as an American species.

Bird Poems

Word comes from Robert Sparks Walker of Chattanooga, Tennessee, that some 3000 poems were received in the bird poetry contest that closed last March. The first award went to Elma Dean of Oakland, California, for a sonnet, "To a Purple Finch"; second prize was given to Charles Henry Mackintosh of Daytona Beach, Florida, for "Foreword to Flight." There were 156 prize-winners, and it is hoped to bring out a book containing all of these and some of the honorable mention poems.

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Under the Microscope

By JULIAN D. CORRINGTON

STORING MICROSLIDES

THIS chapter constitutes an epilogue or postscript to microtechnique. After an object has been successfully mounted, and the slide properly cleaned and labeled, the task is completed so far as that slide is concerned; but it then requires care and storage, and, as the collection grows, the microscopist must decide on the type of box or case that best fits his individual needs, and the system of classification to be employed.

As would be true for any form of collection, the owner of microscope slides will probably go through a series of evolutionary changes in his aims and methods. He will use a small, simple, inexpensive housing at first, shifting to something more elaborate as his items accumulate. Some description, then, of the possibilities will be of interest. A good slide is worthy of proper care, and there may be a few rules or suggestions here that have been overlooked or neglected.

Slides—meaning in every case in this article finished mounts—should *never* be stacked one upon another, even for a moment. Pressure of overlying slides will frequently liquefy the mountant so that some of it will exude from under the cover glass, adhere to the slide next above and, when the two are pulled apart, result in ruining the compressed slide. Obviously, other articles should never be placed on top of slides. The careless worker sometimes strews a number of slides over his work table, then, in absorption over some other occupation, covers some slides with sheets of paper or otherwise hides them from view. After they are forgotten, a bit later, he may put a book down on the table, or his microscope, or lean his elbows upon it, and away go one or more mounts that may have taken much pains to complete. Always keep in mind the exceeding thinness and delicacy of cover glasses and the fact that they are not uniformly supported over mounts of irregular heights. They cannot withstand pressure.

All whole mounts are most safely kept in the flat (horizontal) position. Even when apparently thoroughly hardened, balsam whole mounts will frequently suffer damage when stored vertically. Shells of foraminifera and radiolaria, diatoms, starfish eggs and insect mouthparts, butterfly wing scales, sands, soils, and hosts of similar subjects will gradually drift to the bottom edge of the cover and accumulate in a hopelessly jumbled pile if the slide is stood on edge for any length of time. This is notoriously the case with arranged mounts, as dissected grasshopper mouthparts or diatom exhibition slides. With sections, or smears such as blood, position doesn't matter, but inasmuch as whole mounts and sections probably will be kept in the same container, it is safest to stand that container in such a way that the slides will rest horizontally, cover glasses upward.

A third rule is that slides should never be exposed to light when not in use. Light, especially direct sunlight, will fade stains rapidly and will darken such mountants as balsam. Boxes with lids or cabinets with doors not only keep out light—they also exclude dust, an important item in maintenance of the collection. Do not store slides near a source of heat, as a radiator.

One of our illustrations shows a homemade slide box, easily constructed from plywood, the corners either glued or tacked, or both. The bottom is provided with a felt or cotton liner, the slots are made from corrugated paper, and the lid is affixed with heavy adhesive cloth tape. The lid is made from two pieces of plywood, the inner layer being smaller all around than the outer so as to provide a flange that will fit snugly within the box when closed.

COURTESY WARD'S NATURAL SCIENCE ESTABLISHMENT

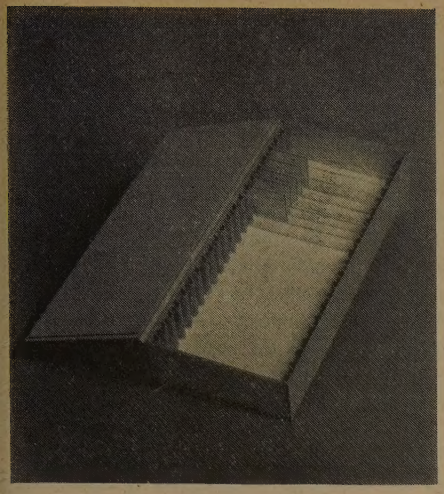
An array of slide containers.

Cotton liners, as they are termed in the trade, may be purchased from supply houses and are thick felts of cheap cotton waste, pressed into a sheet of suitable thickness and furnished in the proper width. They are used principally in shipping slides but may be employed also in the permanent collection as a soft bed upon which the slides rest.

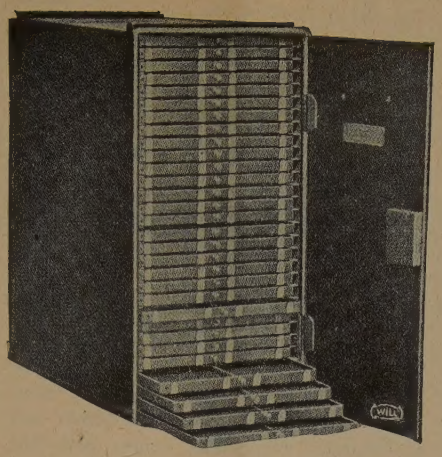
Another illustration shows a variety of inexpensive slide containers. At bottom center is a stack of three mailing blocks, with a fourth lying alongside. These are thin wooden slabs, gouged out to receive a slide resting on a side rail, and with tongue-and-groove construction so that numbers of these may be stacked one upon another, thus protecting slides from damage in the mail. Directly above these is a cardboard mailer for two slides, and, at the left, wooden slot boxes for 3, 4, 6, and 12 slides, similar to that for 25 slides shown at the bottom right. Above the 25 is a finely-made, leather, plush-lined container, with hinged lid and hasp, for the care of a single costly or special slide, as a diatom test or exhibition mount, or a stage micrometer or locator slide.

At the two sides in the upper row are cardboard "pocket" containers used for special collections or single subjects, especially in carrying them to and from exhibitions. They slip into the pocket or luggage without bulk. Lastly, top center, appears the 100-slide container, made of wood throughout, or with wooden frame and cardboard top and bottom, the largest unit short of a cabinet. The lid has brass hinges and hasps. When stood vertically on shelves, these constitute the "books" of one's slide "library."

Of all these, the 25 and the 100 are commonly used for housing collections. The 25-slot wooden box has the great advantage of unit storage by subject. In the small collection there may be one box for each phylum of animals or division of plants; or for such designations as plant histology, insect wings, diatoms, or textiles. As the collection is expanded, more boxes are added and the classification broken down to subheads. For example, the single box on animal histology may become six or a dozen, with the labels indicating epithelium, digestive system, and the like. Later, the slides on the digestive system may require separate boxes on stomach, small intestine, liver, and pancreas. There is no limit to the number of boxes that may be added, as long as the shelf space holds out. Since the 3, 6, and 12-slot boxes have the same depth as the 25, they may be inserted in the series and used for the less populous groups. Chief disadvantage for large collections is the lack of compactness entailed by shelf

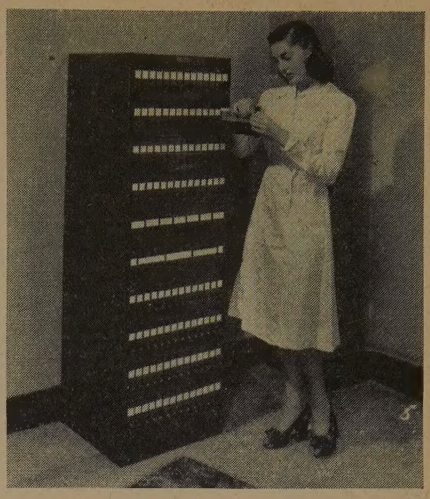


Homemade slide box.



COURTESY OF THE WILL CORPORATION

The Minot all-steel slide cabinet.



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Technicon filing system for slides.

after shelf and row upon row of dust-gathering boxes.

If this system is used, purchase the box with a slip-over cover, not the one illustrated that has a flange cover, and have a rubber stamp made with the word "top" to stamp on the lid, so as to avoid the accident of opening the box when upside down and thus spilling many of the slides on the floor. A collection we once supervised was housed in this manner. Titles for boxes were printed on gummed labels with a typewriter, the label was pressed firmly on the side of a closed box, one-half inch from the top, then, when dry, the label was slit with a safety-razor blade along the crack between bottom and lid of the box. When opened, part of the label was thus attached to the bottom, part to the lid; when closed, the label appeared intact. The boxes were stored in vertical position, side-by-side, on rows of shelves, the labels all aligned near the top of each box. Prominent dividers, with large hand-printed labels on wooden blocks, marked off major divisions. When new items were added or a new box inserted in the series, this meant shifting every box along and often changing or expanding the classification, involving new labels. For single entries of large numbers of slides, the 100 boxes were inserted. In spite of the labor and time needed to make changes, the system worked well.

Slide cabinets are provided with thin and flat drawers and all slides are stored in flat position. One illustrated is of all-steel construction, after a design by Professor Minot. Each drawer takes 24 slides, separated by dividers, and there are 30 drawers, giving a total capacity of 720 slides. The drawers have knobs and label holders, the cabinet a lock and key. Outside dimensions in inches are only 14½ height, 13 depth, and 7 width. This is certainly the safest, neatest and most compact method for the medium-sized collection, and other units can be added if the acquisitiveness and industry of the microscopist so require. Another popular model is made of polished quartered oak, with 25 stamped aluminum trays each holding 20 slides, giving a capacity of 500. These may be stacked side-by-side and one on top of another, an excellent unit system. Still larger models house 1, 2, or 3 thousand slides. .

The modern card-filing system has been adapted to microscope slides in recent years, chiefly by The Technicon Company, 215 East 149 St., New York 51, N. Y., who will send circulars with complete information on request. For large collections, the Technicon apparatus has numerous advantages. In the illustration note the all-steel units that may be purchased separately, as needed, and stacked one upon another. Excluding the base and top, the outfit illustrated has ten units. That which the operator has opened has 14 drawers designed specifically for microslides; more central ones have larger and fewer drawers, for lantern slides, kodachromes, card indices, and other items, and these may be combined in various ways in a single unit as desired. Each drawer works on bearings that prevent sagging, and has a stop when fully extended that prevents accidents from pulling entirely out. The slides are filed vertically and separated by dividers. Indexed cards are inserted where needed. For schools, hospitals, public health and industrial offices, and similar organizations requiring the storage of large numbers of slides, or for the private collector or research microscopist who goes in for slide collections in a big way, this is the most modern, fireproof, and compact of all systems. The only disadvantage is that slides may not be stored flat. If the collection does not include whole mounts, this is of no importance.

As to classification, each preparator must work out the system that best fits his individual needs and specialties. If the organism itself is the main subject, then use a taxonomic scheme. This would be the case in general biology, botany, or zoology, parasitology, embryology, textiles. Often, however, a part or organ is the important subject: in histology, use a standard text, and classify tissues and organs in the order in which they occur in the text, since this sequence is based on a developmental plan. For sands, soils, and thin sections or cell mounts of rocks and minerals, use the classification given in Dana's *System* or Kemp's *Handbook*.

Do not think that, once you have adopted a method of housing or system of classification, there is any compulsion about sticking to either or both. If a scheme proves unwieldy or inelastic, or becomes outmoded, do not hesitate to reorganize and adopt something better.

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BEGINNER'S PRIMER

Skipping over the mosquitoes, which will form the subject of a separate article, our survey of families of the Diptera brings us next to the Simulidae, the black flies. These are terrific scourges, perhaps second only to mosquitoes as tormentors of vacationists and sportsmen. They like bright and hot places along water courses and do not frequent the shade as do so many other types of flies; the females bite viciously and hard, often causing painful swellings.

Adults of this family are small and vary greatly as to color, the term "black fly" being misleading, as some are gray or yellow or orange, and only a few are black. They are all hump-backed, the appearance in side view giving rise to another name, buffalo gnat. The antennae are short and compact, being about the length of the head, but containing eleven segments; there are no ocelli; the compound eyes of females are widely separated and have all of the facets about equal in size, whereas those of males are so large as to meet across the top of the head and each eye is divided transversely, the upper half having facets much larger than those of the lower half. The mouthparts are formed for biting and sucking and are equipped with palpi of four segments. The wings are broad and naked and the legs short and with tibial spurs.

The larvae are aquatic and are usually to be met with in clear, swift streams, especially in rapids and at the brink of or below falls. Here they cling to rocks, often in such large numbers as to form a scum-like coating. They are equipped with suckers fore and aft, fringed with hooks for clinging and aided by a web spun from the mouth; they breathe through rectal blood gills. The mature larva spins a cocoon which is securely fastened to a rock and opens in front, facing downstream. The pupa breathes through two groups of prothoracic tracheal gills.

When the adult hatches it rises to the surface of the water and takes flight instantly. The females breed, then return to lay their eggs, which are attached to grass, leaves, twigs, or to rocks, near or even under the water.

This is a small family of only 300 species, but the number of individuals may at times become enormous. Folsom and Wardle (1934) report that in the great European scourge of 1923, 16,474 domestic animals were killed in Roumania alone from attacks of immense swarms of a freshly-emerged Danubian species.

The most prevalent American black flies are the turkey gnat, *Simulium meridionale,* of the southern States and particularly the Mississippi Valley, which attacks man and all kinds of domestic animals; the southern buffalo gnat, *Eusimulium pecuarum,* now less common than formerly, when it constituted a serious menace to mules and other stock; the Adirondack black fly, *Prosimulium hirtipes,* whose blood-sucking proclivities keep anglers out of Adirondack and New England trout streams during May and June; and the white-stockinged black fly, *Simulium venustum,* with white marks on the tibiae, of eastern North America. The last is by no means the pest that is *P. hirtipes,* a fact interestingly brought out by Comstock, who quotes a letter from Needham, stating: "Guides have a saying, that, when the black-flies put on their white stockings in June, the trouble is about over."

The innoxious black fly, *Simulium pictipes,* is common in the East, while the western States are scourged by two bad species, the yellow gnat, *Prosimulium fulvum,* and *Simulium bivittatum.* Some African species transmit a filarial worm to man that brings on a subcutaneous disease, onchocerciasis.

Adults and their parts are well worth mounting, but the most interesting slides as regards this family are made from the larvae and pupae.

FRESHMAN LAMENT

Zoology
You are to me
A source of great perplexity;
I cut up frogs and try to be
Acquainted with each artery,
But find them where they shouldn't be,
But are.

Zoology
You'll ever be
A most amazing mystery;
I look in microscopes and see
Some things that glower back at me,
Some things that never ought to be,
But are.

Zoology
Where will I be
When you have handed me my D?
I breed some black Drosophilae,
But F_2 takes a sock at me,
The darned things *can't* be verdigris,
But are!

A.S.A.M.

Information about the American Society of Amateur Microscopists, its activities and requirements for membership may be obtained by writing to Herman W. Fowler, Secretary, 2729 Connecticut Avenue, Pittsburgh 16, Pennsylvania.